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SITE ASSESSMENT, INVESTIGATION AND CHARACTERIZATION OF RECREATIONAL VEHICLE FAMILY CAMPING AREA NAS FORT WORTH TX
7/1/1996
THE ENVIRONMENTAL COMPANY

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NAVAL AIR STATION FORT WORTH JRB CARSWELL FIELD TEXAS

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A.F.

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WORK PLAN and QUALITY PROGRAM PLANS

Site Assessment, Investigation, and Characterization of the Recreational Vehicle (RV) Family Camping (Fam Camp) Area

AF CENTER FOR ENVIRONMENTAL EXCELLENCE

July 1996

Naval Air Station (NAS) Fort Worth Joint Reserve Base (JRB) Carswell Field, Texas

Contract No. F41624-95-D-8002
Delivery Order 0003

WORK PLAN

SITE ASSESSMENT, INVESTIGATION, AND CHARACTERIZATION OF THE RECREATIONAL VEHICLE (RV) FAMILY CAMPING (FAM CAMP) AREA

NAVAL AIR STATION (NAS) FORT WORTH
JOINT RESERVE BASE
CARSWELL FIELD, TEXAS

Contract No. F41624-95-D-8002
Delivery Order 0003

July 1996

Prepared for:

Department of the Air Force
Headquarters (HQ) Human Systems Center (HSC) PKVCC
3207 North Road
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PREFACE

A site assessment/investigation (SA/SI) and a site characterization (SC) of the area in the vicinity of the Recreational Vehicle (RV) Family Camping (Fam Camp) Area at Naval Air Station (NAS) Fort Worth, Joint Reserve Base, Carswell Field, Texas (identified as Project No. 95-8021) will be conducted to determine the presence or absence of contamination and to define the nature and extent of such contamination if present.

This Work Plan (WP) was prepared by The Environmental Company, Inc. (TEC) under contract No. F41624-95-D-8002, Delivery Order 0003. This WP is a project scoping document for Project No. 95-8021.

This WP provides a summary of existing information, presents an overview of project organization, and describes the methods to be utilized in completing the SA/SI and the SC.

This WP was written under the direction of Mr. Glenn M. Metzler, TEC Project Manager. The Contracting Officer's Representative for this project is Mr. Charles Rice, Air Force Center for Environmental Excellence (AFCEE), Environmental Restoration Branch (ERB), Brooks Air Force Base (AFB), Texas.

Approved By: Date:

Glenn M. Metzler — July 9, 96

Glenn M. Metzler
Project Manager
The Environmental Company, Inc.

Approved By: Date:

Jack E. Wilson — July 7, 1996

Jack E. Wilson, P.E.
Project Director
The Environmental Company, Inc.

NOTICE

This report has been prepared for the United States Air Force by The Environmental Company, Inc. (TEC) for the purpose of aiding in the implementation of a final remedial action plan under the Air Force Installation Restoration Program (IRP).

Although the area of study is being investigated in accordance with IRP guidance, the area has not been identified as an IRP site. NAS Fort Worth (formerly Carswell Air Force Base) is undergoing property disposal/reuse pursuant to the Defense Base Closure and Realignment Act of 1990 and Round II of the Base Closure Commission deliberations. The area of study is being considered for property disposal or reuse and the Air Force Base Conversion Agency (AFBCA) desires to investigate the area to confirm or deny the presence of contamination.

As the report relates to actual or possible releases of potentially hazardous substances, its release prior to a United States Air Force final decision on remedial action may be in the public's interest. The limited objectives of this report and the ongoing nature of the IRP, along with the evolving knowledge of site conditions and chemical effects on the environment and health, must be considered when evaluating this report since subsequent facts may become known that may make this report premature or inaccurate.

Acceptance of this report in performance of the contract under which it is prepared does not mean that the Air Force adopts the conclusions, recommendations, or other views expressed herein, which are those of the contractor only and do not necessarily reflect the official position of the United States Air Force.

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REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY *(Leave blank)*

2. REPORT DATE
July 1996

3. REPORT TYPE AND DATES COVERED
Final-July 1996

4. TITLE AND SUBTITLE
WORK PLAN
SITE ASSESSMENT, INVESTIGATION, AND CHARACTERIZATION OF THE RECREATIONAL VEHICLE (RV) FAMILY CAMPING (FAM CAMP) AREA
NAVAL AIR STATION (NAS) FORT WORTH
JOINT RESERVE BASE (JRB)
CARSWELL FIELD, TEXAS

5. FUNDING NUMBERS
F41624-95-D-8002
Delivery Order 0003

6. AUTHOR(S)
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NA

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Base Closure Division
Brooks AFB, TX 78235

10. SPONSORING/MONITORING AGENCY REPORT NUMBER
NA

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

This Work Plan provides a summary of existing information, presents an overview of project organization, and describes the methods to be used to complete the Site Assessment/Site Investigation and Site Characterization of the area in the vicinity of the Recreational VehicleFamily Camping Area at Naval Air Station Fort Worth, Joint Reserve Base, Carswell Field, Texas.

14. SUBJECT TERMS
WORK PLAN

15. NUMBER OF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT
Unclassified

18. SECURITY CLASSIFICATION OF THIS PAGE
Unclassified

19. SECURITY CLASSIFICATION
Unclassified

20. LIMITATION OF ABSTRACT

NSN 7540-01-280-5500

Standard Form 298 (Rev 2-89)
Prescribed by ANSI Std 239-18
298-102

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LIST OF ACRONYMS AND ABBREVIATIONS

ACC	Air Combat Command
AF	Air Force
AFB	Air Force Base
AFBCA	Air Force Base Conversion Agency
AFCEE	Air Force Center for Environmental Excellence
ARAR	Applicable or Relevant and Appropriate Requirements
BTEX	Benzene, Toluene, Ethyl-Benzene, Xylenes
CDRL	Contract Data Requirements List
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COR	Contracting Officers Representative
DBCRA	Defense Base Closure and Realignment Act
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DOD	Department of Defense
DTIC	Defense Technical Information Center
EC	Electrical Conductivity
ECD	Electron Capture Detector
ERB	Environmental Restoration Branch
Fam Camp	Family Camping
FID	Flame-Ionization Detector
FS	Feasibility Study
FSP	Field Sampling Plan
GC	Gas Chromatography
GMI	Geo-Marine, Inc.
HSA	Hollow-Stem Auger
HSP	Health and Safety Plan
HQ	Headquarters
IDW	Investigative Derived Waste
IRP	Installation Restoration Program
IRPIMS	Installation Restoration Program Information Management System
LPST	Leaking Petroleum Storage Tank
ITIR	Informal Technical Information Report
MSL	Mean Sea Level
NAS	Naval Air Station
NCP	National Contingency Plan

PID	Photoionization Detector
PVC	Poly-Vinyl Chloride
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QPP	Quality Project Plan
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RLS	Registered Land Surveyor
RV	Recreational Vehicle
SA/SI	Site Assessment/Site Investigation
SAC	Strategic Air Command
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SC	Site Characterization
SCS	Site Characterization Summary
SDWA	Safe Drinking Water Act
SOW	Statement of Work
SVOC	Semi-Volatile Organic Compound
TAC	Texas Administrative Code
TAL	Target Analyte Listing
TEC	The Environmental Company, Inc.
TNRCC	Texas Natural Resources Conservation Commission
TPH	Total Petroleum Hydrocarbons
TR	Technical Report
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WBS	Work Breakdown Structure
WP	Work Plan
YMCA	Young Men's Christian Association

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1.0 INTRODUCTION

This Work Plan (WP) was prepared by The Environmental Company, Inc. (TEC) under Contract No. F41624-95-D-8002, Delivery Order 0003. This WP defines the scope of services for the site assessment/investigation (SA/SI) and site characterization (SC) of an area in the vicinity of the Recreational Vehicle (RV) Family Camping (Fam Camp) Area at Naval Air Station (NAS) Fort Worth, Joint Reserve Base, Carswell Field, Texas (Project No. 95-9021). The Statement of Work (SOW) for Project No. 95-9021 is included with this WP as Appendix A.

This WP was prepared in accordance with guidelines provided in the Headquarters (HQ) Air Force Center for Environmental Excellence (AFCEE) *Handbook for the Installation Restoration Program (IRP) Remedial Investigations and Feasibility Studies (RI/FS),* dated September 1993 (hereafter referred to as the Handbook). The Handbook presents standard outlines and information requirements for IRP scoping documents. The outlines presented in the Handbook are required to be used in the preparation of IRP scoping documents. This WP is consistent with the WP outline and section numbering scheme presented in the Handbook. All components of the standard outline are addressed in this WP. It should be noted that, where appropriate, the section numbering system presented in the Handbook was expanded to accommodate further levels of detail.

Although the area is being investigated in accordance with IRP guidance, the area has not been identified as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site. NAS Fort Worth (formerly Carswell Air Force Base) is undergoing property disposal/reuse pursuant to the Defense Base Closure and Realignment Act of 1990 and Round II of the Base Closure Commission deliberations. The area of study is being considered for property disposal or reuse. There have been no previous investigative activities in the area of study and there is no documentation regarding existing or potential contamination. The Air Force Base Conversion Agency (AFBCA) desires to investigate this area to confirm or deny the presence of contamination.

1.1 Description of the Air Force Installation Restoration Program

The objective of the U.S. Air Force Installation Restoration Program (IRP) is to assess past hazardous waste disposal and spill sites at U.S. Air Force installations and develop remedial actions consistent with the National Contingency Plan (NCP) for those sites that pose a threat to human health and welfare or the environment.

The Resource Conservation and Recovery Act (RCRA), enacted in 1976, governs the disposal of hazardous wastes. RCRA Sections 6001 and 6003 require Federal agencies to comply with local and state environmental regulations and provide information to the U.S. Environmental Protection Agency (USEPA) concerning past disposal practices at Federal sites.

CERCLA, enacted in 1980, outlines responsibilities for identifying and remediating contaminated sites in the United States and its possessions. CERCLA legislation identifies the USEPA as the primary policy and enforcement agency regarding contaminated sites.

The Superfund Amendments and Reauthorization Act (SARA), enacted in 1986, extends the requirements of CERCLA and modifies CERCLA with respect to goals for remediation and the selection of remedial technologies/processes. SARA favors technologies that provide permanent removal or destruction of a contaminant over technologies that only contain or isolate the contaminant. SARA also provides for greater interaction with public and state agencies and extends the role of the USEPA in evaluating health risks associated with contamination. SARA requires the early determination of Applicable or Relevant and Appropriate Requirements (ARARs) and recommends that potential remedial alternatives be considered during the initial phase of the RI/FS.

Executive Order 12580, adopted in 1987, gave various Federal agencies, including the Department of Defense (DOD), the responsibility to act as lead agencies for conducting investigations and implementing remediation efforts when the Federal agencies are the sole or co-contributor to contamination on or off their properties.

To ensure compliance with CERCLA and Executive Order 12580, the DOD developed the IRP under the Defense Environmental Restoration Program to identify potentially contaminated sites, investigate these sites, and evaluate and select remedial actions for contaminated sites. The DOD issued Defense Environmental Quality Program Policy Memorandum (DEQPPM) 80-6 regarding the IRP program, dated June 1980. The DOD formally revised and expanded IRP directives, and amplified all previous directives and memoranda concerning the IRP, through DEQPPM 81-5, dated 11 December 1981. The memorandum was implemented by a U.S. Air Force message dated 21 January 1982.

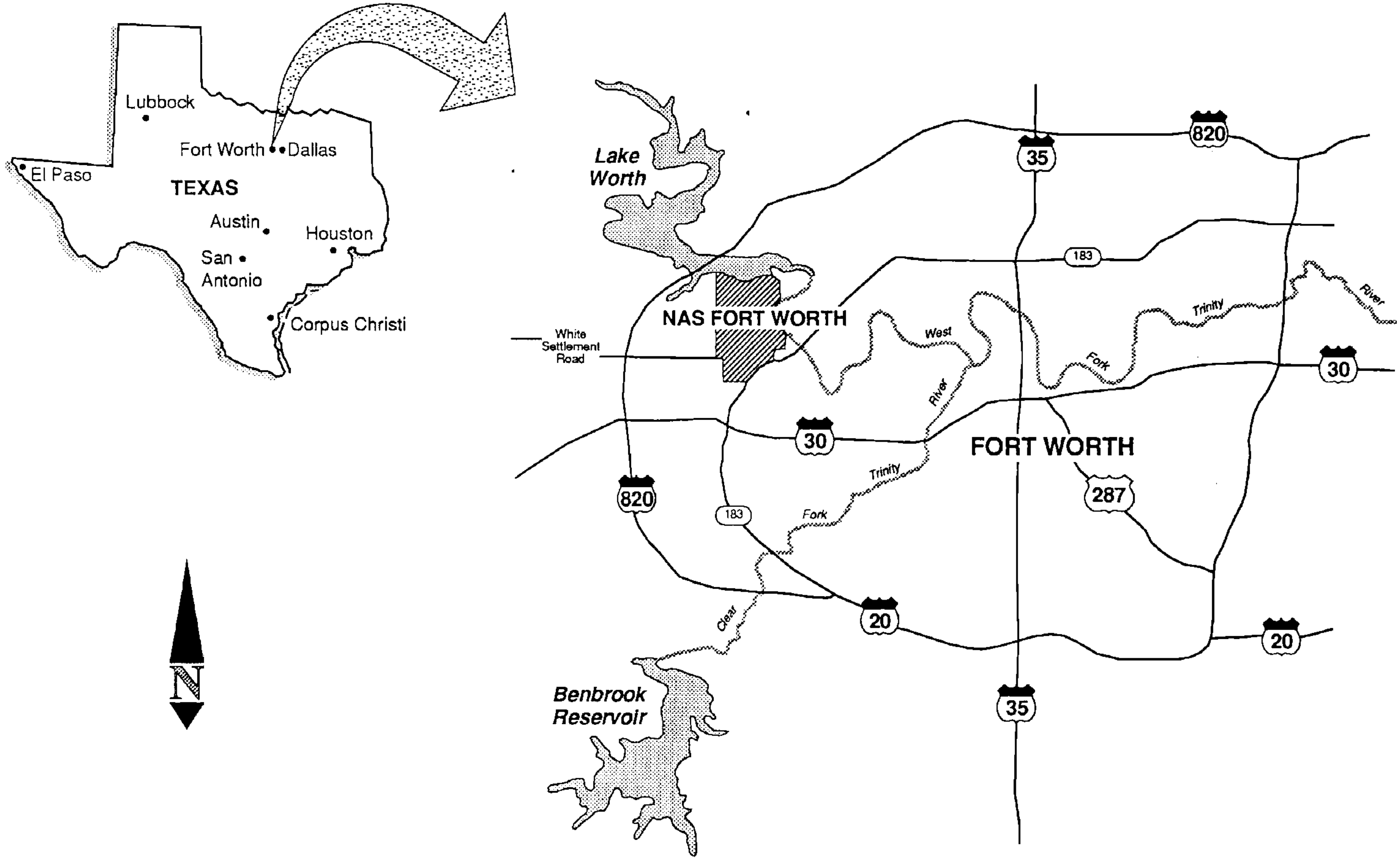
The IRP is the primary mechanism for implementing response actions on U.S. Air Force installations affected by the provisions of SARA. In November 1986, in response to SARA and other USEPA interim guidance, the U.S. Air Force modified the IRP to provide for an RI/FS program. The IRP was modified so that RI/FS studies could be conducted as parallel activities rather than serial activities. The IRP now encompasses ARAR determinations, identification and screening of remedial technologies, and the development of remedial alternatives. A project conducted under the IRP may include multiple field activities and studies prior to a detailed final analysis of remedial alternatives. IRP requirements have been developed to ensure DOD compliance with Federal laws such as RCRA, CERCLA, and SARA.

1.2 History of IRP Activities at NAS Fort Worth

The IRP was initiated at NAS Fort Worth in 1984 with a records search and study conducted by CH_2M Hill, Inc. This study identified 15 sites requiring further evaluation. Since the IRP was initiated, several other IRP studies have been conducted at NAS Fort Worth that identified additional sites. NAS Fort Worth currently has 19 active IRP sites. It should be noted that the area of study is not an IRP site.

1.2.1 NAS Fort Worth Description

NAS Fort Worth is located in north-central Texas in Tarrant County, approximately 8 miles west of the downtown area of the City of Fort Worth. Figure 1-1 presents an NAS Fort Worth Location Map.



Date	8 May 1996
Project Manager	G. Metzler
Prepared by	EAD
Project No.	P3103

The Environmental Company, Inc.

SOURCE: Radian Corporation 1986

0 2 4 miles

FIGURE 1-1

NAS FORT WORTH LOCATION MAP

NAS Fort Worth property totals 2,555 acres and consists of a main station and two noncontiguous land parcels. The area surrounding NAS Fort Worth is predominantly suburban, including the residential areas of the City of Fort Worth, Westworth Village, and White Settlement.

The main station is comprised of 2,264 acres and is bordered on the north by Lake Worth, on the east by the Trinity River and Westworth Village, on the northeast and southeast by the City of Fort Worth, on the west and southwest by White Settlement, and on the west by Air Force Plant 4 (Lockheed).

Public and recreational land surrounds Lake Worth north of the station; however, public access along the southern shore of the lake is restricted due to NAS Fort Worth activities. Private recreation lands, a fish hatchery, and a Young Men's Club of America (YMCA) camp are located along the West Fork of the Trinity River northeast of the station. East and southeast of the station are various types of residential development; a commercial area is located south of the station at the interchange of Interstate Highway I-30 and State Highway 183. This commercial area includes a discount retail center, a shopping mall, and a convenience store. Land uses west of the station are primarily residential and industrial and include single-family residences, Air Force Plant 4, commercial centers, and an industrial complex in White Settlement.

1.2.1.1 NAS Fort Worth History

The land area currently known as NAS Fort Worth was originally an earthen runway constructed to service an aircraft manufacturing facility. When established in 1942, the installation was referred to as the Tarrant Field Airdrome and was under the jurisdiction of the Gulf Coast Army Air Field Training Command. The installation mission was to provide transition training for B-24 bomber pilots.

The Strategic Air Command (SAC) assumed control of Tarrant Field Airdrome in 1946 and the installation served as the Headquarters (HQ) for the Eighth Air Force and as a heavy bomber base. The installation was renamed Carswell Air Force Base (AFB) in 1948 in honor Major Horace S. Carswell, a City of Fort Worth native. HQ 19th Air Division was located at Carswell AFB in 1951 and the installation became home base for B-52s and KC-135s in 1956. The Air Combat Command (ACC) assumed control of Carswell AFB in 1992 concurrent with the disestablishment of the SAC.

Carswell AFB was selected for closure and associated property disposal/reuse during Round II of Base Closure Commission deliberations pursuant to the Defense Base Closure and Realignment Act (DBCRA) of 1990. The planning process for closure and property disposal/reuse at Carswell AFB was initiated in 1992 and Carswell AFB officially closed on 30 September 1993.

The U.S. Navy assumed control of Carswell AFB on 1 October 1994 and renamed the installation NAS Fort Worth, Joint Reserve Base, Carswell Field (hereafter referred to as NAS Fort Worth).

1.2.2 Previous Investigative Activities and Documentation

There have been no previous investigative activities in the area of study for this project and there is no documentation regarding existing or potential contamination.

It should be noted that Geo-Marine, Inc. (GMI) completed a groundwater quality survey across a major portion of NAS Fort Worth. The findings of this survey are documented in the *Phase I & II Report, Groundwater Survey & Subsurface Soil Delineation, Hydrant Fueling System, Carswell Air Force Base, Fort Worth, Texas,* prepared by GMI, dated February 1995. This groundwater survey did not specifically address the area of study for this project; however, several groundwater samples (GMI18-228P, GMI18-229P, GMI18-230P, GMI18-231P, GMI18-232P, GMI18-233P, and GMI18-263P) were collected in areas adjacent to the area of study (i.e., within a reasonable distance of the jet fuel distribution line present in the area of study). Analyses of these groundwater samples indicated all analytes to be present in non-detectable concentrations. Analytes included total petroleum hydrocarbons (TPH), benzene, toluene, ethyl-benzene, and xylenes (BTEX), and nine halocarbons (e.g., trichloroethene, tetrachloroethene, vinyl chloride). The GMI report should be referenced for sampling methods, laboratory analytical methods, etc.

It should also be noted that the SOW for Project No. 95-9021 references the sampling of three existing groundwater monitoring wells as a component of project activities (see Appendix A). TEC has reviewed existing monitoring well locations at NAS Fort Worth and determined that all existing monitoring wells are outside the area of study. Existing monitoring wells will not be sampled during SA/SI or SC activities.

1.2.3 Existing Remedial Actions

Not applicable.

1.3 Description of Current Study

NAS Fort Worth is supplied with jet fuel (JP8 currently, JP4 in previous years) through a privately owned/operated distribution line originating in Aledo, Texas. The jet fuel distribution line runs parallel with Highway 183 to the intersection of Roaring Springs. The line then crosses the NAS Fort Worth golf course in the vicinity of the RV Fam Camp Area until reaching Rogner Drive. The line turns north to parallel Rogner Drive and crosses Farmers Branch Creek in the vicinity of Ascol Drive. The jet fuel distribution line continues north until entering the main station and terminating at the Bulk Fuel Storage Area.

Reportedly, sometime in calendar year 1990 the City of Fort Worth was performing boring operations in the Farmers Branch Creek near the main entrance to the station and detected strong odors of fuel. The station reported this to the distribution line owner. The distribution line owner reportedly conducted pressure tests and determined that the distribution line was not leaking. Currently, there are no records of the boring operations or the pressure tests to confirm these findings.

The AFBCA desires to investigate this area to confirm the presence or absence of contamination, and to determine the nature and extent of any contamination that may be present. AFBCA has labeled this site on the DD Form 1391 as the "RV parking area (Fam Camp)."

1.3.1 Project Objectives

The objectives of this SA/SI and SC are to determine the presence or absence of contamination in the area of study and to define the nature and extent of such contamination if determined to be present. The area of study includes:

- the RV Fam Camp Area, including the abandoned sewage collection system and associated leach field; and
- the area in the immediate vicinity of the jet fuel distribution line. This area extends along the length of the distribution line which begins at the base near Ascol Drive at the north end of the golf course, and continues across the golf course. The line exits the base near the intersection of White Settlement Road and Highway 183, and runs along Highway 183 for approximately 1,500 linear feet to the end of U.S. Air Force property. It should be noted that actual property lines and linear footage are to be established by TEC during survey activities.

Figure 1-2 identifies the overall area of study to include the RV Fam Camp Area and the area in the immediate vicinity of the jet fuel distribution line. Figure 1-2 also identifies Farmers Branch Creek and the approximate area where strong fuel odors are reported to have been observed.

1.3.2 Project Scoping Documents

This WP constitutes one of the scoping documents required by the SOW for this contract and delivery order. Other scoping documents prepared by TEC for this contract and delivery order include a Quality Project Plan (QPP), consisting of a Health and Safety Plan (HSP) and a Sampling and Analysis Plan (SAP), with the latter consisting of a Field Sampling Plan (FSP) and a Quality Assurance Project Plan (QAPP). These scoping documents should be referenced as necessary and appropriate.

1.3.3 Summary of Project Activities

SA Activities. A visual observation of site conditions will be made to note areas of discolored soils, stressed vegetation, and/or other indicators of potential contamination. Selected surface soils will be screened with a photoionization detector (PID) for volatile organic compounds (VOCs). A land survey will be conducted to locate pertinent site features, easements, and property boundaries. A utilities location survey, utilizing NAS Fort Worth personnel, existing site plans, and public utility-locator services, will be conducted to identify the location and orientation of all underground utilities in areas where sorbers will be placed during SI activities.

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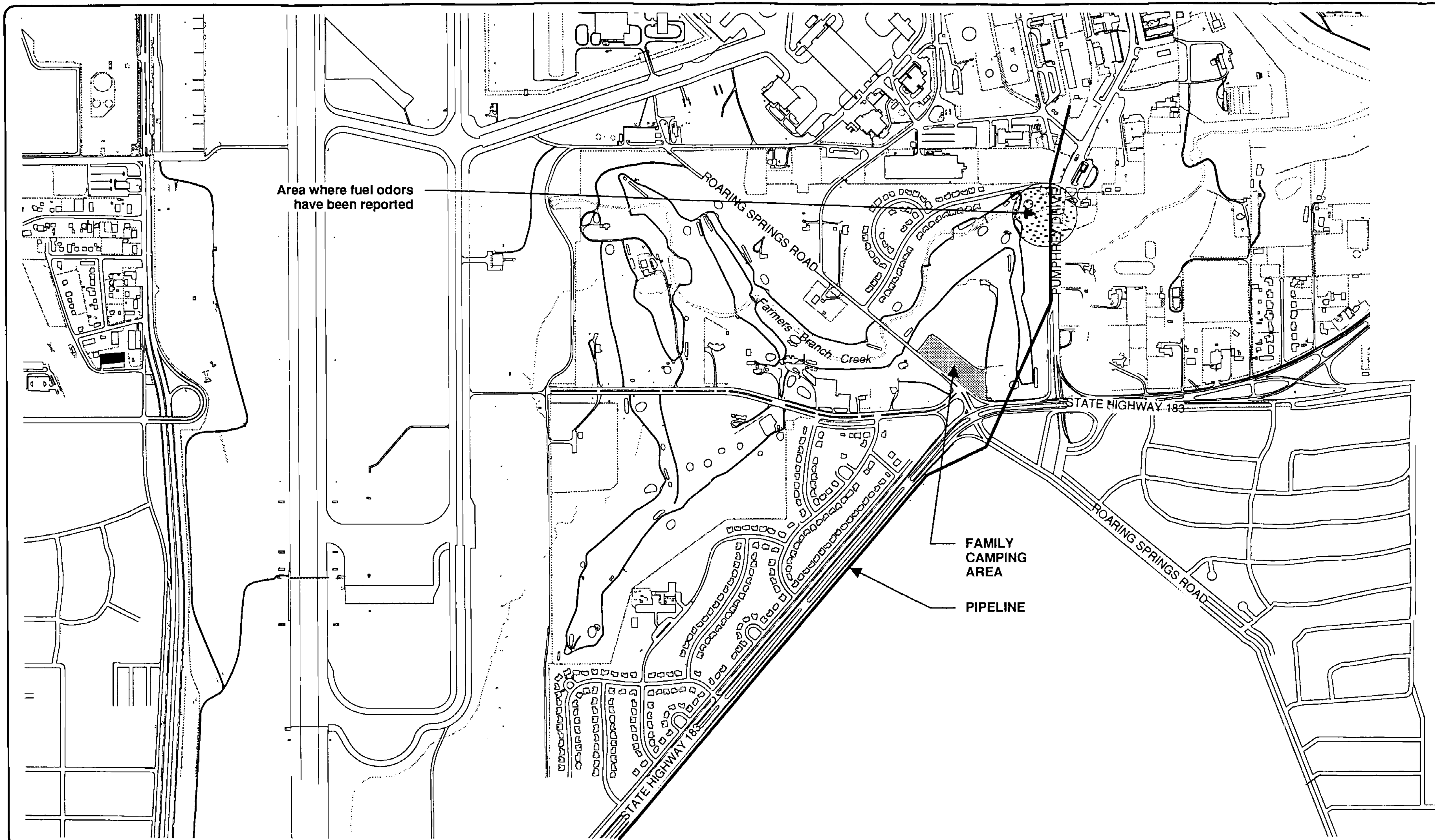

Date July 1996
Project Manager G. Metzler
Prepared by EAD
Project No. P3103
The Environmental Company, Inc.

FIGURE 1-2

NAS FORT WORTH
SITE MAP

SI Activities. Soil gas surveys will be conducted along the jet fuel distribution line and in the RV Fam Camp Area. GORE-SORBER® Passive Sorbent Collection Devices (sorbers) will be placed directly above the centerline of the jet fuel distribution line at 50-foot intervals (approximately 63 monitors total, including three duplicates). An effort will be made to identify the locations (or approximate locations) of distribution line joints. Where possible, sorbers will be placed in the immediate area above these distribution line joints. Sorbers are also to be placed within the RV Fam Camp Area (approximately seven monitors total, including one duplicate).

Soil gas sample analyses will target a general fuel hydrocarbon list to BTEX, alkanes, and certain semi-volatile organic compounds (SVOCs).

SC Activities. Based on SA/SI data/findings, up to 20 soil boring locations will be identified in the area of study as deemed appropriate and necessary.

A utilities location survey, utilizing professional geophysical services, will be conducted to identify the location and orientation of all underground utilities in areas where soil borings will be advanced. A geophysical survey will also be conducted in the RV Fam Camp Area to locate the abandoned leachfield.

Soil samples will be collected during the soil boring activities by split-spoon or solid core sampling techniques. The depth of all soil borings will be to 5 feet below the encountered groundwater table. Preliminary information indicates that the depth to groundwater will not exceed 30 feet from ground surface elevation and that groundwater will be reached prior to bedrock. Soil samples will be collected at 2-foot intervals for screening purposes; however, only two samples from each borehole will be submitted for laboratory analysis.

All soil samples will be analyzed for TPH. All soil samples will also be analyzed for BTEX, or the more comprehensive method 8240 analyte list, to assess volatile organic compound contamination (differentiation based on visual observation and soil screening results). Selected soil samples (again based on observation and screening results) will be analyzed for Target Analyte List (TAL) inorganic compounds as a general contaminant scan and to investigate potential contamination from other sources. Grain size analyses will be performed on selected samples to provide data regarding potential contaminant migration and remedial options.

Additional characterization of hydrocarbon contamination using a hydrocarbon fingerprinting technique will be implemented if petroleum contamination is identified at the site. Hydrocarbon fingerprinting will be implemented since there are two petroleum distribution lines and other potential sources of hydrocarbon contamination present within the area of study. Hydrocarbon fingerprinting will assist in identifying which potential source of contamination is/was the actual contaminant source.

Soil samples that are collected from the RV Fam Camp Area in the vicinity of the abandoned leach field will be analyzed for a larger set of parameters due to the potential for other contamination at this site. Analyses will include TPH, VOCs, SVOCs, pesticides, polychlorinated biphenyls, and TAL inorganic compounds. Grain size of soils will also be determined for at least two samples.

It is anticipated that zero to six groundwater monitoring wells will be installed and developed at various site locations. The necessity for groundwater monitoring well installation will be determined based on observations, soil gas survey results, soil sample screening, and soil sample laboratory analytical results. The purpose of the groundwater monitoring wells is to investigate potential groundwater contamination and obtain data on local hydrogeology.

Should groundwater monitoring wells be installed and developed during SC activities, these groundwater monitoring wells will be purged and sampled. Groundwater sample analyses will include BTEX and TPH.

Reporting of Findings. One Technical Report (TR) and several Informal Technical Information Reports (ITIRs) will be prepared. The TR to be prepared is a SA/SI and SC Report (one comprehensive report), to include Conceptual Site Models (CSMs) and an ecological/baseline risk assessment. Analytical Data ITIRs, Accelerated Remediation Project Definition ITIRs, and Site Characterization Summary (SCS) ITIRs will also be prepared as necessary and appropriate.

All data generated during SA/SI and SC activities will be delivered in an Installation Restoration Program Information Management System (IRPIMS) format.

1.4 Project Organization and Responsibilities

TEC has assembled a team of highly qualified professionals to both manage and execute the range of tasks required for the successful completion of this project. Figure 1-3 is a project organizational chart that identifies key project personnel. Table 1-1 presents point-of-contact information for key project personnel.

FIGURE 1-3. PROJECT ORGANIZATION

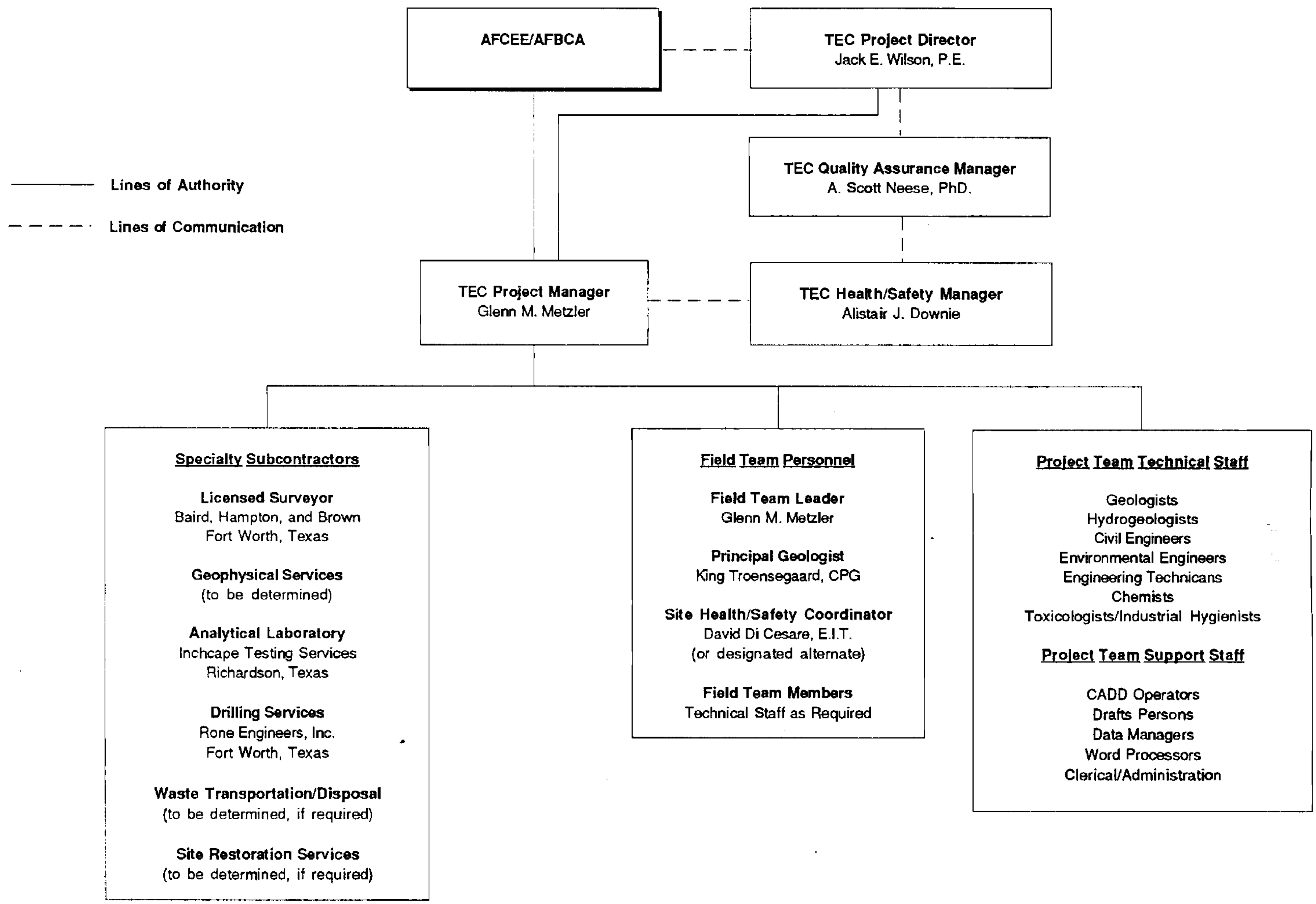

TABLE 1-1. KEY PERSONNEL POINT-OF-CONTACT LISTING

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Mr. Charles Rice **AFCEE COR/TC**	AFCEE/ERB 3207 North Road, Bldg. 532 Brooks AFB, TX 78235-5363 (210) 536 6452 (210) 536 3609 (FAX)
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Mr. Olen Long, P.E. **AFBCA Site Manager/Base POC**	AFBCA/OL-H 6550 White Settlement Road Fort Worth, TX 76114-8137 (817) 731 8284 (817) 731 8137 (FAX)
Mr. Jack E. Wilson, P.E. **TEC Project Director**	The Environmental Company, Inc. 1230 Cedars Court, Suite 100 Post Office Box 5127 Charlottesville, VA 22905 (804) 295 4446 (804) 295 5535 (FAX) JEWILSON@tecinc.com (electronic)
Mr. Glenn M. Metzler **TEC Project Manager**	The Environmental Company, Inc. 1230 Cedars Court, Suite 100 Post Office Box 5127 Charlottesville, VA 22905 (804) 295 4446 (804) 295 5535 (FAX) GMMETZLER@tecinc.com (electronic)

2.0 SUMMARY OF EXISTING INFORMATION

This section provides a summary of existing information associated with the area of study. Where applicable and appropriate, sources of the information are referenced.

2.1 NAS Fort Worth Environmental Setting

NAS Fort Worth is located within the Grand Prairie section of the Central Lowlands Physiographic Province. The land area is characterized by broad terrace surfaces sloping gently eastward, interrupted by westward-facing escarpments. The topography of the station is fairly flat, except for areas near Farmers Branch Creek and the Trinity River. Elevations average 650 feet above mean seal level (MSL) and range from a low of 550 feet above MSL in the east to a high of 690 feet above MSL in the southwest.

The climate in the region is sub-humid with mild winters and warm humid summers. The average annual precipitation is 31.5 inches with the majority of precipitation falling between the months of April and October. The average annual air temperature is 66 degrees Fahrenheit (°F). July is the warmest month with an average monthly air temperature of 86 °F and January is the coldest month with an average monthly air temperature of 45 °F. Temperature changes may be rapid in the region and often change 20 °F to 30 °F in a matter of hours. The average annual relative humidity is 63 percent.

Prevailing winds are primarily southerly from March through November and northerly from December through February. The average wind speed is 8 knots. Thunderstorms with wind speeds in excess of 65 knots as well as hail storms are common in the region. Climate conditions in summer make tornado formations possible.

The principal hydrogeologic units underlying NAS Fort Worth include the Terrace Alluvium Aquifer, and the Upper, Middle, and Lower Paluxy Aquifers. The Paluxy Aquifers are bedrock hosted. The Terrace Alluvium Aquifer is the uppermost aquifer and occurs in unconsolidated material and in the Goodland Formation. The unconsolidated material constituting the Terrace Alluvium is predominantly alluvial and fluvial deposits of clay, silt, sand, and gravel. The Goodland Formation is a thinly to massively bedded fossiliferous limestone. The Terrace Alluvium Aquifer is only partially saturated and is not used as a source of drinking water. Recharge of the aquifer is from precipitation and leaking water supply lines, sewer lines, and storm drains. Discharge seeps into unnamed small streams and the Trinity River.

The Paluxy Aquifers are hosted by fine- to medium-grained sandstone separated by clays and shales of the Paluxy Formation. The Middle Paluxy Aquifer serves as a water supply source for the community of White Settlement. The Paluxy Aquifers are hydraulically separated from the Terrace Alluvium Aquifer by the Walnut Formation, a limestone coquina. The Walnut Formation has been subjected to subaerial erosion and this suggests the possibility of local hydraulic communication between the Terrace Formation Aquifer and the deeper Paluxy Aquifers.

2.2 Site-Specific Environmental Setting

The following subsections provide a brief summary of available information on the area of study. The entire area of study (i.e., the area along the jet fuel distribution line and the RV Fam Camp Area) is considered to be one site.

2.2.1 Contaminant Sources and Contamination

As previously noted, the City of Fort Worth reported strong odors of fuel while performing boring operations in the Farmers Branch Creek near the main entrance to the station (reference SOW for Project No. 95-8021). The station reported this to the distribution line owner and the owner reportedly conducted pressure tests and determined that the distribution line was not leaking (reference SOW for Project No. 95-8021). There are no records of the boring operations or the pressure tests.

Potential contaminant sources include the jet fuel distribution line and the abandoned leach field at the RV Fam Camp Area. A second commercial petroleum distribution line is adjacent and parallel to a section of the jet fuel distribution line serving NAS Fort Worth. This second line may also be a potential contaminant source.

The potential exists that a release occurred from one or both of the petroleum distribution lines resulting in petroleum hydrocarbon contamination of soil and/or groundwater. Contaminants of interest include petroleum hydrocarbons.

The jet fuel distribution line, is an active 6-inch diameter line that is owned/operated by Pride Refining, Inc. (Pride). This distribution line currently provides NAS Fort Worth with JP-8 and has provided NAS Fort Worth with JP-4 in the past. The second commercial distribution line is owned/operated by Chevron and has reportedly carried various grades of refined petroleum products (i.e., gasoline, diesel). The distribution line was recently purged with nitrogen and currently does not contain petroleum.

The potential also exists that hazardous substances were introduced into the wastewater collection system that is associated with the abandoned leach field at the RV Fam Camp Area (conversations with Mr. Olen Long, P.E., AFBCA Site Manager). The RV Fam Camp Area is unsecured (i.e., there is no surrounding fence) and the area is immediately adjacent to State Highway 183. Unauthorized disposal of motor oils, cleaning fluids, and other household-type wastes by individuals utilizing the RV Fam Camp Area may have occurred in the past. Four-inch diameter poly-vinyl chloride (PVC) sewer pipe inlets protrude from the ground surface in the RV Fam Camp Area and are highly visible. Contamination of soil and/or groundwater in the area of the abandoned leach field may have resulted from such unauthorized dumping activities. Contaminants of interest include petroleum hydrocarbons and a broad range of other hazardous compounds (e.g., pesticides, polychlorinated biphenyls, metals).

Soil gas samples are to be collected along the jet fuel distribution line and in the RV Fam Camp Area during SA/SI activities. Soil gas sample analyses will target a general fuel hydrocarbon list to include BTEX, alkanes, and certain SVOCs.

Based on SA/SI findings, soil boring locations will be identified along the jet fuel distribution line. Soil samples will be collected from these locations during SC activities. Soil sample analyses will include TPH and BTEX. Selected samples will be analyzed for TAL inorganic compounds as a general contaminant scan and to investigate potential contamination from other sources.

Based on SA/SI findings, soil boring locations will also be identified in the vicinity of the abandoned leach field in the RV Fam Camp Area. Soil samples will be collected from these locations during SC activities. Soil sample analyses will encompass a larger set of parameters due to the potential for other contamination to be present. Soil sample analysis will include TPH, VOCs and SVOCs, pesticides, polychlorinated biphenyls, and TAL inorganic compounds.

Grain size analysis will be performed on selected samples to provide data regarding potential contaminant migration and applicable remedial options.

It is anticipated that zero to six groundwater monitoring wells will be installed and developed at various site locations. Should groundwater monitoring wells be installed and developed during SC activities, these groundwater monitoring wells will be purged and sampled. Groundwater sample analyses will include TPH and BTEX.

2.2.2 Geology

Site-specific geologic data is not available. Reference Section 2.1 for a general discussion on the NAS Fort Worth environmental setting and geologic features.

2.2.3 Groundwater

Site-specific groundwater data is not available. Reference Section 2.1 for a general discussion on the NAS Fort Worth environmental setting and hydrogeologic features.

2.2.4 Surface Water

Site-specific surface water data is not available. Reference Section 2.1 for a general discussion on the NAS Fort Worth environmental setting.

2.2.5 Air

Site-specific air data is not available. Reference Section 2.1 for a general discussion on the NAS Fort Worth environmental setting and meteorological data.

2.2.6 Biology

Site-specific data regarding the ecological environment is not available. Reference Section 2.1 for a general discussion on the NAS Fort Worth environmental setting.

2.2.7 Demographics

Site-specific demographic data is not available. Reference Section 2.1 for a general discussion on the NAS Fort Worth environmental setting and demographic features.

2.3 Conceptual Site Model

Table 2-1 provides a summary of the existing information on the natural conditions and contamination at the site in a conceptual site model (CSM) format.

Since there have been no previous investigative activities in the area of study and since there is no documentation regarding existing or potential contamination, the information presented in the CSM summary is very limited. A plan view and cross-section drawing of the CSM are not included with this WP.

2.4 Remedial Action

Not applicable.

2.4.1 Preliminary Remedial Action Objectives

Not applicable.

2.4.2 Preliminary Alternatives

Not applicable.

2.5 Applicable or Relevant and Appropriate Requirements (ARARs)

Applicable or relevant and appropriate requirements (ARARs) were determined based on the CSM. Since there have been no previous investigative activities in the area of study and since there is no documentation regarding existing or potential contamination, the ARARs presented in this subsection should be viewed as preliminary.

Title 30 of the Texas Administrative Code (TAC), Chapter 334, Underground and Aboveground Storage Tanks, presents regulatory criteria associated with leaking petroleum storage tank (LPST) sites. These criteria establish procedures for determining target contaminant concentrations for remedial action.

The Texas Natural Resource Conservation Commission (TNRCC), Petroleum Storage Tank Division, has published technical guidance regarding LPST sites. TNRCC Technical Guidance: *Action Levels for LPST Sites*, dated October 1993, identifies action levels for petroleum contamination in soils at LPST sites. This document can be used as a general guidance document for determining action levels for petroleum contamination in soils. In general, contaminant levels in soils shall not exceed the established action levels. TNRCC action levels are listed in Table 2-2 (presented on page 2-6).

Maximum contaminant levels (MCLs), established by the Safe Drinking Water Act (SDWA), are used as general action levels for petroleum contamination in groundwater.

TABLE 2-1. CONCEPTUAL SITE MODEL (CSM) SUMMARY

Site Identification	Site Description	Background Concentrations	Contaminants and Contaminated Media	Migration Pathway(s)	Exposed Population	Risk Estimate
Project No. 95-8021	RV Fam Camp Area, including the abandoned sewage collection system and associated leach field; and the area in the immediate vicinity of the jet fuel distribution line. Reported petroleum odors near a stream initiated action at the site. Nature and extent of contamination (if present) is yet to be determined. Potential contaminant sources include the jet fuel distribution line and the abandoned leach field at the RV Fam Camp Area. A second commercial petroleum distribution line, adjacent and parallel to a section of the jet fuel distribution line, is also a potential contaminant source. Surface water is in close proximity to the site. Preliminary data indicates: that depth to groundwater will not exceed 30 feet from surface elevation; and that groundwater will always be reached prior to bedrock.	Prior environmental sampling has not been conducted to identify background concentrations of the target contaminants.	Prior environmental sampling has not been conducted to identify contaminants and/or contaminated media.	Potential pathways for contaminant migration at the site include groundwater and surface water.	Site-specific data is required to estimate the exposed population for each exposure pathway.	Site-specific data is required to estimate risk numerically.

TABLE 2-2. TNRCC SOIL ACTION LEVELS

Constituents	Action Levels (ppm) Fine Grained Soils[1]	Action Levels (ppm) Coarse Grained Soils[1]
Benzene	0.500	0.500
Ethyl-benzene	70	10
Toluene	100	20
Xylenes	560	70
TPH Middle Distillate Releases[2]	500	500
TPH Gasoline Releases[2]	100	100

[1] Apply the fine soil standard to sites dominated with clays and silts. Apply the coarse soil standards to sites dominated with sands, gravels, and rock units.

[2] Apply the middle distillate TPH standard to diesel, kerosene, jet fuel, fuel oil, hydraulic oil, and waste oil releases. Apply the gasoline standard to aviation gasoline releases. In a tankhold with gasoline and diesel tanks, the gasoline standard will apply unless it can be demonstrated that gasoline has not been released.

2.6 Data Needs

The objectives of the SA/SI and SC activities are to determine the presence or absence of contamination and to define the nature and extent of such contamination if determined to be present in the area of study. Data necessary to accomplish these objectives includes:

- **Geophysical Data**. Geophysical data is necessary to locate the leachfield associated with the abandoned septic system at the RV Fam Camp Area.
- **Land Survey Data**. Land survey data is necessary to accurately locate the jet fuel distribution line, property boundaries, easements, soil boring and sample locations, and groundwater monitoring well locations.
- **Soil Screening Data**. Soil screening data is necessary to identify areas of potential contamination within the area of study. GORE-SORBER® sorbers will be used to generate soil gas data. Analysis of soil gas will target a general fuel hydrocarbon list to include BTEX, alkanes, and certain SVOCs.
- **Soil Characteristics Data**. Soil characteristics data is necessary to understand the geologic conditions in areas of potential contamination. Lithologic data will be recorded during soil boring activities. Grain size analysis will also be conducted on selected soil samples.
- **Soil Contamination Data.** Soil contamination data is necessary in areas of potential contamination to identify the types and concentration of contaminants present in subsurface soils. Soil samples are to be collected during soil boring activities. Soil sample analyses will include TPH, BTEX, and TAL inorganic compounds.
- **Groundwater Characteristics Data**. Groundwater characteristics data is necessary in areas of potential contamination to understand the hydrogeologic conditions. The depth to groundwater table will be recorded during well sampling activities. Direction of groundwater flow will also be determined.
- **Groundwater Contamination Data.** Groundwater contamination data is necessary to identify the types and concentrations of contaminants present in groundwater. Up to six groundwater monitoring wells will be installed. Groundwater sample analyses will include TPH and BTEX.
- **Biologic Data**. Biologic data is necessary to define the ecological environment surrounding areas of potential contamination. Common biotic communities will be identified as well as any sensitive environments.
- **Demographic Data**. Demographic data is necessary to determine population densities and land use surrounding areas of potential contamination. This data will be obtained during SA/SI activities.

Intentionally blank.

3.0 REMEDIAL INVESTIGATION/FEASIBILITY STUDY TASKS

RI/FS tasks include all SA/SI and SC activities. These activities are described in general terms in this section. Details regarding field activities, sampling methods, laboratory analytical methods, and quality assurance procedures are provided in the SAP (i.e., in the FSP and the QAPP). Health and safety procedures are also separately provided in the HSP. Reference should be made to these scoping documents as necessary and appropriate.

3.1 Site Objectives

The site objectives of this SA/SI and SC are to collect sufficient data to determine the presence or absence of contamination in the area of study and to define the nature and extent of such contamination if determined to be present. Data needs are identified in Section 2.6 of this WP.

3.2 Field Investigation

As per the Work Breakdown Structure (WBS) presented in the SOW for Project No. 95-9021, Section 3.5 (see Appendix A), field investigation activities were subdivided into SA/SI activities and SC activities.

3.2.1 Site Assessment/Site Investigation (SA/SI)

An SA/SI will be conducted in the area of study to define the area environmental setting, to identify sites that are potentially contaminated, and to assess potential sources of contamination. Preliminary SA/SI tasks include a literature search and records review (see Section 3.3 for complete detail). SA/SI field tasks include a land survey, utilities location, visual observation of site conditions, PID screening of selected surface soils, and the placement/retrieval of sorbers.

3.2.1.1 SA/SI Field Tasks

Land Survey. A State of Texas-registered land surveyor (RLS) will conduct a historical records review and identify existing easements, property boundaries, and adjacent landowners. Site plans will be developed.

Utilities Location. A utilities location survey, utilizing NAS Fort Worth personnel, existing site plans, and public utility-locator services, will be conducted to identify the location and orientation of all underground utilities in areas where sorbers will be placed during SI activities.

Visual Observation. A visual observation of site conditions will be made to note areas of discolored soils, stressed vegetation, and/or other indicators of potential contamination. An evaluation of site accessibility and security will also be made.

PID Soil Screening. Selected surface soils will be screened with a PID for VOCs. Soil screening results will be used as an indicator of potential hydrocarbon contamination.

Soil Gas Sorber Placement. A soil gas survey will be conducted along the jet fuel distribution line and in the RV Fam Camp Area. TEC will use GORE-SORBER® Passive Sorbent Collection Devices (sorbers) to conduct the soil gas survey.

GORE-SORBER® sorbers have been used in environmental projects spanning six USEPA Regions (I, II, III, IV, V, and IX). The USEPA has approved project work plans for these environmental projects and conducted an audit of W. L. Gore & Associates, Inc. (Gore) laboratory facilities (USEPA Region I). Regulatory agencies in 15 states, including the State of Texas, have also approved project work plans incorporating the use of GORE-SORBER® sorbers. GORE-SORBER® sorbers have been used in several projects at AFBs, to include projects performed by ICF Kaiser at Wurtsmith AFB and Anderson AFB that were coordinated through AFCEE.

GORE-SORBER® sorbers are sheathed in the base of a vapor-permeable insertion and retrieval cord. A small diameter penetration is advanced manually using a slam-bar. Total depth of these slam bar penetrations will be 2- to 3-feet below surface elevation. Sorbers will be installed directly above the centerline of the jet fuel distribution line at 50-foot intervals (approximately 63 monitors total, including three duplicates) and throughout the RV Fam Camp Area (approximately seven monitors total, including one duplicate). The sorbers will be retrieved 14 days from the date of placement and submitted for laboratory analyses.

TEC will make an effort to identify the locations (or approximate locations) of joints/couplings along the jet fuel distribution line (see Section 3.3). A potential release from a subsurface distribution line is most likely to occur in the area of these joints. Where possible, sorbers that will be placed along the centerline of the jet fuel distribution line will be placed in the immediate area above distribution line joints.

3.2.1.1.1 SA/SI Aquifer Testing

Not applicable.

3.2.1.1.2 SA/SI Geophysical Surveys

Not applicable.

3.2.1.2 SA/SI Sampling and Analysis Activities

SA/SI sampling activities consist of completing the soil gas surveys along the jet fuel distribution line and in the abandoned leach field of the RV Fam Camp Area. This will include the installation/retrieval of 70 sorbers (see Section 3.2.1.1). Soil gas analyses will target a general fuel hydrocarbon list to include BTEX, alkanes, and certain SVOCs. SA/SI results will be used to define areas of concern for Site Characterization efforts.

3.2.2 Site Characterization (SC)

An SC will be conducted following the SA/SI. The SC will be conducted in areas of potential contamination to define the nature and extent of contamination, identify the source of contamination, characterize environmental site conditions, and quantitatively estimate the risk posed by the contamination to human health and the environment.

SC field tasks include a geophysical and utilities location survey, soil boring/sampling, monitoring well installation/development, and groundwater sampling. Investigative derived wastes (IDW) will be generated during these activities. IDW will be properly managed and disposed. IDW will be containerized, labeled, stored in the designated secure area provided by AFBCA, and subsequently disposed of off site by a qualified waste transporter at a licensed disposal facility.

3.2.2.1 SC Field Tasks

Geophysical survey. A geophysical survey will be conducted to locate the abandoned leachfield in the RV Fam Camp Area (see section 3.2.2.1.2)

Utilities Location Survey. A utilities location survey, utilizing a professional geophysical service provider, will be conducted to identify the location and orientation of all underground utilities in areas where soil borings will be advanced.

Soil Boring. Based on prior SA/SI findings, up to 20 soil boring locations will be identified as appropriate and necessary. Hollow-stem auger (HSA) drilling techniques will be used. The HSA allows for the insertion of sampling tools (e.g., split-spoon sampler) and well completion materials while the augers are in place supporting subsurface soils. Depth of all soil borings will be to approximately 5 feet below the encountered groundwater table.

Soil Screening. Soil samples will be collected at 2-foot intervals during soil boring operations for screening purposes. Soils will be screened with PID for VOCs. Soil screening results will be used as an indicator of potential hydrocarbon contamination.

Soil Sampling. Two soil samples will be collected from each borehole and submitted for laboratory analysis. Soil samples will be collected during boring activities by split-spoon or solid core sampling techniques.

Well Placement/Installation/Development. It is estimated that up to six groundwater monitoring wells will be installed and developed at various site locations. The necessity for groundwater monitoring well installation will be determined by a TEC hydrogeologist based on a review of data generated by completed SA/SI and SC activities, including site observations, soil gas survey results, soil sample screening results, unvalidated soil sample laboratory analytical results, contaminant fingerprinting results, and all other available data.

TEC will use 4-inch inside diameter Schedule 80 PVC well screen and riser. The groundwater monitoring wells will be constructed with a 15-foot section of 0.02-inch slotted Schedule 80 PVC well screen. The top of the well screen will be positioned approximately 10 feet above the static groundwater table.

It should be noted that Texas is currently under very dry weather conditions. As a result, the static groundwater table throughout the area of study may be depressed (i.e., the measured depth to the static groundwater table may be greater than the measured depth under normal weather conditions).

Use of a 15-foot section well screen and positioning the top of the well screen 10 feet above the static groundwater table will account for the depressed static groundwater table and allow the monitoring well to continue to function properly upon return to normal weather conditions.

The filter pack shall consist of clean, chemically inert, and well-rounded silica sand or gravel and shall extend from the bottom of the borehole to a depth approximately 2 feet above the top of the well screen. A sodium bentonite seal, at least 2 feet thick, will be placed between the filter pack and the overlying casing grout. Casing grout shall extend from the top of the bentonite seal to the ground surface. Groundwater monitoring wells will be completed using either flush-mounted or aboveground surface completions. The identification of the groundwater monitoring well will be permanently marked on the casing cap. All groundwater monitoring wells will be properly developed.

Well Gauging. An electronic interface probe shall be used to determine the static groundwater level (i.e., depth to groundwater) and the presence or absence of floating product. Should floating product be observed, the depth to the product and the product layer thickness will be determined.

Well Purging/Sampling. Well purging will be performed prior to well sampling to evacuate water that has been stagnant in the groundwater monitoring well and not representative of the aquifer. Purging will be accomplished using a bailer. A minimum of three well volumes will be removed from the well prior to sampling. Wells with water yields too low to produce three well volumes will be purged to dryness. Temperature, pH, electrical conductivity (EC), and turbidity will be measured. Groundwater samples will be collected using dedicated bottom-filling PVC bailers. Disposable nylon rope will be used to lower and retrieve the bailers.

IDW Disposal. Should significant quantities of IDW be generated through site activities, TEC will retain a qualified waste transporter to remove IDW from the site for disposal at a licensed facility. TEC has identified several local area transporters with the capability of handling non-hazardous and hazardous wastes. All IDW will be properly containerized and stored during field activities.

Site Restoration. Should site conditions following SC activities necessitate significant site restoration, TEC will retain a qualified subcontractor to restore site conditions to pre-investigation conditions. Activities which may necessitate site restoration include heavy equipment usage and/or drilling operations. Site restoration activities, if needed, will be coordinated with NAS Fort Worth representatives.

3.2.2.1.1 SC Aquifer Testing

Not applicable.

3.2.2.1.2 SC Geophysical Surveys

A geophysical survey will be conducted to locate the abandoned leachfield in the RV Fam Camp Area, and if necessary, confirm the location of the jet fuel distribution line and underground utilities. Magnetometry and/or electromagnetic (EM) survey techniques are the geophysical methods tentatively selected.

Magnetometer surveys measure variations in the Earth's magnetic field. Measurements of the magnetic gradient can be used to locate buried ferrous objects such as tanks, pipelines, and metallic debris.

EM surveys measure the electrical conductivity of a subsurface volume. The measured values, referred to as terrain conductivity, are obtained without direct ground contact and can be used to map the location of objects and/or contaminant plumes (e.g., hydrocarbons in high concentrations or other conductive/resistive compounds).

3.2.2.2 SC Sampling and Analysis Activities

Soil sampling will be conducted during soil boring activities. A total of 40 soil samples will be collected (two samples per soil boring, 20 soil borings total).

All soil samples will be analyzed for TPH. All soil samples will also be analyzed for BTEX, or the more comprehensive method 8240 analyte list, to assess VOC contamination (differentiation based on visual observation and soil screening results). Selected soil samples (again based on observation and PID screening results) will be analyzed for TAL inorganic compounds as a general contaminant scan and to investigate potential contamination from other sources. Grain size analyses will be performed on selected samples to provide data regarding potential contaminant migration and remedial options.

Additional characterization of hydrocarbon contamination using a hydrocarbon fingerprinting technique will be implemented if petroleum contamination is identified at the site. Hydrocarbon fingerprinting will be implemented since there are multiple potential contaminant sources. Hydrocarbon fingerprinting will assist in identifying which potential source of contamination is the actual contaminant source.

The proposed hydrocarbon fingerprinting technique is an interpretation of gas chromatographic (GC) analyses using pattern matching. Contaminants are extracted from sample media and injected into a GC. The contaminant is disassociated into its individual constituents based primarily on the boiling points of the constituents. The individual constituents are separately detected using a flame ionization detector (FID) and an electron capture detector (ECD). Based on the retention time of the constituents in the instrument, and a comparison of the resulting chromatographic patterns with a reference library of products (e.g., gasoline, diesel, JP4, JP8), it is possible for the analytical laboratory to identify the exact type of product present in the contaminated sample media.

Soil samples that are collected from the RV Fam Camp Area in the vicinity of the abandoned leach field will be analyzed for a larger set of parameters due to the potential for other contamination to be present. Analyses will include TPH, VOCs and SVOCs, pesticides, polychlorinated biphenyls, and TAL inorganic compounds. Grain size analyses will be also performed on selected samples to provide data regarding potential contaminant migration and remedial options.

Groundwater sampling will be conducted following monitoring well installation and development. Groundwater samples that are collected from the six newly installed groundwater monitoring wells will be analyzed for TPH and BTEX.

IDW samples will also be collected and submitted for analyses. IDW sample analyses will focus on parameters necessary for proper characterization and disposal.

3.3 Literature Search

A literature search will be conducted prior to SA/SI and SC field activities in order to identify existing records, data, and other information associated with the area of study. All relevant documents will be reviewed by TEC project team personnel.

One objective of this literature search is to obtain available information on the two petroleum distribution lines in the area of study (i.e., the jet fuel distribution line and the commercial petroleum distribution line). Information to be obtained shall include data on the physical characteristics of the distribution lines (e.g., construction materials, diameter, locations of joints and/or couplings), dates and methods of installation (e.g., are the actual lines surrounded by gravel fill, with/without liner), and the types of products carried through the lines. TEC will fully research the potential that a release from one (or both) of these petroleum distribution lines has occurred and resulted in contamination of the surrounding environment.

3.4 Record Keeping

TEC field personnel will maintain field data log books. In addition to the log books, TEC field personnel will complete and maintain standard field data forms for all field activities. Example field data forms are collectively presented in the FSP. These field data forms include:

- Field Sampling Reports;
- Chain-of-Custody Documentation;
- Soil Gas Survey Data Sheets;
- Soil Gas Survey Sample Data Sheets;
- Boring Logs;
- Monitoring Well Construction Details and Abandonment Forms;
- Monitoring Well Development Records;
- Monitoring Well Purging Forms;
- Monitoring Well Static Water Level Forms;
- Instrument Calibration Log Sheets; and
- Instrument Maintenance Records.

3.5 Data Quality Assessment

A data quality assessment will be conducted following the completion of all SA/SI and SC activities. The assessment will include a review and evaluation of all data generated.

A review of field records will be conducted to determine completeness, validity of samples collected, and the correlation of field data. Any anomalies in data will be identified and evaluated. A discussion regarding field data quality and sample validity will be provided in the technical report (TR) (see Section 4.10).

An independent review of laboratory data will be conducted to determine the validity of all analyses provided. This review will focus on:

- chain-of-custody documentation;
- holding times;
- method calibration limits;
- method blanks;
- laboratory verification of quantitation limits;
- preparatory batch control records;
- corrective actions;
- formulas used for analyte quantitation;
- examples of analyte quantitation; and
- completeness of data.

This review of laboratory data will also ensure that all samples and analyses required by the SAP have been processed, complete records exist for each analysis and any associated QC measures, and procedures specified in this WP and the SAP have been implemented. A complete discussion regarding analytical data validity will be provided in the TR.

An evaluation of valid environmental data will be conducted. Based on the data reviews, data generated through poor field or laboratory practices will not be considered in the evaluation. Historical data that is not supported by proper documentation will also not be considered in the evaluation. Field duplicate, field blank, and laboratory blank analytical results as well as sample matrix effects will be reviewed and a complete discussion regarding data evaluation and findings will be provided in the TR.

3.6 Characterization of Background Conditions

There have been no prior investigative activities in the area of study and there is no documentation regarding background conditions. The potential for contamination does exist in the area of study (see Section 2.2.1 for a discussion of potential contaminant sources and potential contamination).

Characterization of background conditions will be conducted during the SA/SI and SC activities (e.g., placement of a soil boring outside the area of potential contamination to obtain background data on soil composition, subject contaminant concentrations, etc.).

3.7 Risk Assessment

A baseline/ecological risk assessment will be conducted to estimate the potential risk to human health and the environment resulting from exposure to site contaminants. The baseline/ecological risk assessment will be conducted in accordance with the Handbook and guidance provided in:

- USEPA, *Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual*, EPA/540/1-89/002, December 1989;
- USEPA, *Risk Assessment Guidance for Superfund, Volume 2: Environmental Evaluation Manual*, EPA/540/1-89/001, March 1989;
- USEPA, *Framework for Ecological Risk Assessment*, EPA/630/R-92/001, February 1992; and
- MITRE Corporation, *Technical Report, General Guidance for Ecological Risk Assessment at Air Force Bases* (i.e., Appendix C to the Handbook).
- Texas Administrative Code - 334.203, Risk-Based Criteria for Establishing Target Concentrations.

The level of effort and detail provided for the risk assessment will be commensurate with the amount and types of contamination identified during the site characterization. The risk assessment will include identification of chemicals of potential concern to human health and the environment, exposure pathways analysis, and exposure and toxicity assessments. Chemicals of concern will be determined through utilization of USEPA and State of Texas threshold levels or through preliminary risk calculations.

Due to the nature of the potential contamination (i.e., an underground release) and the lack of sensitive environments in proximity to the site, a limited risk assessment component is anticipated.

The risk assessment component of the TR will include appropriate tables, figures, references, and supporting data. Conclusions and recommendations regarding the necessity for remedial action will be made. If no unacceptable risks are identified, a recommendation of no further action will be made on the basis of the risk assessment.

3.8 Bench Scale/Treatability Studies

Not applicable.

3.9 Detailed Analysis of Alternatives

Not applicable.

4.0 REPORTING REQUIREMENTS

This section details project reporting requirements. All deliverable products/reports will be prepared and submitted in accordance with the SOW and the applicable Contracts Data Requirements Lists (CDRLs) (see Appendix A). CDRL Data Item Numbers are indicated in brackets following each subsection to facilitate reference with Appendix A.

4.1 Project Scoping Documents

This WP constitutes one of the project scoping documents required by the SOW for this contract and delivery order. Other scoping documents required by the SOW include a QPP consisting of an HSP and an SAP, with the latter consisting of an FSP and a QAPP. [A002, A003, A004]

4.2 Monthly Status Reports

TEC will complete and submit monthly financial and management reports. These Monthly Status Reports will be organized according to the standardized Work Breakdown Structure (WBS) to describe the status of expenditure of funds correlated with the progress of the work completed. [A001AB, B006, B007]

4.3 Change of Contractor Personnel

TEC has provide an organizational chart displaying key personnel involved in this project and their respective labor categories with the first Monthly Status Report. TEC will notify the Contracting Officers Representative (COR) of any significant changes in project personnel and provide an updated organization chart as necessary and appropriate. [A001AA]

4.4 Project Meeting Minutes

TEC will complete and submit project meeting minutes to document all items discussed at project meetings. All project meeting attendees will be listed in the minutes. [B005]

4.5 Project Schedules

TEC has prepared a computer-generated network analysis that is a detailed task plan for all WBS tasks (see Section 5.0). The network analysis will be in the form of a Gantt chart to indicate appropriately the percentage of work scheduled for completion by any given date during the period of the delivery order. The Gantt chart will show both serial and parallel subtasks leading to a deliverable. [B001]

4.6 Presentation Materials

TEC will prepare and present briefing packages for project meetings coordinated by the U.S. Air Force. TEC will provide hardcopies of all slides and overheads as a hand-out during these project meetings. [B004]

4.7 Photo Documentation

TEC will provide color photo documentation as deemed necessary and appropriate, including documentation of site features, sample locations, and SA/SI and SC field activities. Color photographs will be included with technical reports. Photographic negatives will also be provided with final submittals. [A031]

4.8 Preliminary Laboratory Review Packages

TEC will not submit a preliminary laboratory review package for the analytical laboratory selected because the analytical laboratory has been audited by AFCEE within the past 6 months. [A035]

4.9 Informal Technical Information Reports (ITIRs)

Informal Technical Information Reports (ITIRs) will be submitted as required by the SOW (see Appendix A). Analytical Data ITIRs, Accelerated Remediation Project Definition ITIRs, and Site Characterization Summary ITIRs are relevant to this project.

4.9.1 Analytical Data ITIR

TEC will prepare all analytical data, including QA/QC results and cross-reference tables, in an Analytical Data ITIR format. The format of the hardcopy Analytical Data ITIR will be in accordance with the Handbook. Electronic data will conform with IRPIMS data requirements. [A009]

4.9.2 Accelerated Remediation Project Definition ITIRs

TEC will prepare Accelerated Remediation Project Definition ITIRs on a site-by-site basis dependent upon the levels and extent of contamination present. TEC will submit an annotated outline for content and format approval by AFCEE prior to document preparation. The document will contain all available qualitative and quantitative information necessary to define requirements for site remediation. Proposed remedial alternatives will be described as will a recommended approach with quantitative information regarding the area/volume to be remediated, cleanup goals and objectives, potential remedial technologies, and associated cost estimates. [A010]

4.9.3 Site Characterization Summary ITIR

TEC personnel will prepare a Site Characterization Summary (SCS) ITIR in accordance with the general outline presented in the Handbook. An annotated outline of each section of the SCS ITIR will be submitted prior to preparation. The SCS ITIR will include source identification and contaminant delineation, identification and ranking of appropriate treatability studies for listed sites, iso-concentration plots of contaminants detected at each site, lithographs of each boring showing contaminants detected and relationship to other borings in the site, and cross-sections of the site showing contaminant distribution. [A011]

4.10 Technical Report

One Technical Report (TR) will be submitted. As required by the SOW (see Appendix A), an SA/SI Report and an SC Report are relevant to this project. These reports, the SA/SI Report and the SC Report, will be submitted as one comprehensive TR.

4.10.1 Site Assessment/Investigation Report

TEC will prepare an SA/SI Report as a component of the comprehensive TR, documenting the activities and findings of the SA/SI. The SA/SI Report will describe the environmental setting of the area of study, identify potential sources of contamination, and present the findings of all SA/SI activities. [A007]

4.10.2 Site Characterization Report

TEC will prepare Site Characterization (SC) Report, as a component of the comprehensive TR, in accordance with OSWER 9355.3-01, "Guidance for Conducting Remedial Investigation and Feasibility Studies under CERCLA" dated October 1988. The SC Report will be specific to those areas of potential contamination and will include CSM(s) based on SA/SI and SC findings and the results of an ecological/baseline risk assessment. [A008]

4.10.2.1 Conceptual Site Model (CSM)

TEC personnel will develop CSM(s) for the RV Fam Camp Area and other areas along the distribution line identified as areas of contamination. The CSM(s) will define the nature and extent of contamination, the hydrogeologic regime, and the transport and fate of contaminants. The complexity and detail of the CSM(s) will be consistent with the nature of the site and the data available. The CSM(s) will be submitted as a component of the TR. [A025]

4.10.2.2 Ecological/Baseline Risk Assessment

TEC personnel will conduct an Ecological/Baseline Risk Assessment using validated data generated during the SC and using the CSM(s) developed. The ecological/baseline risk assessment will be conducted in accordance with the Handbook. TEC will document the Ecological/Baseline Risk Assessment and will include the assessment results as a component of the TR. [A026]

4.11 IRPIMS Data

TEC personnel will prepare all data to meet IRPIMS data requirements. TEC will record field and analytical laboratory data into an electronic format as required by the most current version of the *IRPIMS Data Loading Handbook*. Individual IRPIMS data files (analytical results, groundwater level data), including re-submissions, will be delivered with a transmittal letter to AFCEE in sequence with associated hard copy error reports. Data entered into IRPIMS data files will correspond exactly with the data contained in original laboratory reports and other documentation associated with field sampling and laboratory activities. [B003]

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5.0 PROJECT SCHEDULE

A project schedule to complete the SA/SI and SC activities is provided in Appendix B. The project schedule is presented in the form of a color Gantt Chart.

Project milestones and document submittal dates are indicated on the project schedule. Serial and parallel subtasks leading to a deliverable are also indicated on the project schedule.

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6.0 REFERENCES

GMI. 1995 (February). *Phase I & II Report, Groundwater Survey & Subsurface Soil Delineation, Hydrant Fueling System, Carswell Air Force Base, Fort Worth, Texas.*

U.S. Air Force. 1993 (September). *Handbook for the Installation Restoration Program (IRP) Remedial Investigations and Feasibility Studies (RI/FS).* Headquarters, Air Force Center for Environmental Excellence, Brooks Air Force Base, Texas.

U.S. Air Force. 1996 (January). Scope of Work, Site Assessment, Investigation, and Characterization of the Recreational Vehicle (RV) Family Camping (Fam Camp) Area, Naval Air Station (NAS) Fort Worth, Joint Reserve Base, Carswell Field, Texas, Project No. 95-8021.

U.S. Environmental Protection Agency. 1989 (March). *Risk Assessment Guidance for Superfund, Volume 2: Environmental Evaluation Manual,* EPA/540/1-89/001.

U.S. Environmental Protection Agency. 1989 (December). *Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual,* EPA/540/1-89/002.

U.S. Environmental Protection Agency. 1992 (February). *Framework for Ecological Risk Assessment,* EPA/630/R-92/001

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APPENDIX A

STATEMENT OF WORK

SITE ASSESSMENT, INVESTIGATION, AND CHARACTERIZATION OF THE RECREATIONAL VEHICLE (RV) FAMILY CAMPING (FAM CAMP) AREA

NAVAL AIR STATION (NAS) FORT WORTH
JOINT RESERVE BASE
CARSWELL FIELD, TEXAS

PROJECT NO. 95-8021

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STATEMENT OF WORK

SITE ASSESSMENT, INVESTIGATION, AND CHARACTERIZATION OF THE RECREATIONAL VEHICLE (RV) FAMILY CAMPING (FAM CAMP) AREA AT NAVAL AIR STATION (NAS) FORT WORTH, TEXAS

1.0 INTRODUCTION

The purpose of this statement of work (SOW) is to provide services, technical man-hours, and materials for the site assessment, investigation and characterization of the area in the vicinity of the RV Fam Camp Area at NAS Fort Worth, Texas (TX). The Contractor shall report on the presence or absence and nature and extent of contamination in this area. Additional services include the collection, testing, analysis, and reporting of contaminants present in soil, water, and wastewater samples.

1.1 SCOPE

1.1.1 In carrying out any work assignment issued, the Contractor shall furnish the necessary personnel, services, equipment, materials, and facilities and otherwise do everything necessary for or incidental to the performance of work set forth herein.

1.1.2 Primary services shall include services to perform a Site Assessment/Site Investigation (SA/SI) and a Site Characterization (SC) of the RV Fam Camp Area adjacent to the JP-4 distribution line. The area of study shall be parallel to the JP-4 distribution line, beginning at Highway 183 and extending north to the Bulk Fuel Storage Area (approximately 3,000 linear feet).

1.1.3 Secondary services incidental to these services include topographical and geophysical surveys and sampling of soil, groundwater, and pipeline contents.

1.2 BACKGROUND

1.2.1 Base Background. Not applicable to this Delivery Order (DO).

1.2.2 Site Descriptions. NAS Fort Worth is supplied with jet fuel through a privately owned JP-4 distribution line which comes from Aledo, Texas. The distribution line runs parallel with Highway 183 to the intersection of Roaring Springs. It then cuts across the base's golf course in the vicinity of the RV Fam Camp Area until it gets to Rogner Drive. The line then turns north to parallel Rogner Drive as it approaches the Main Entrance to the base. It crosses the Farmers Branch Creek at the vicinity of Ascol Drive. According to a blueline print of the Comprehensive Plan of the Liquid Fuel System, dated May 1986, the pipeline owner's responsibility for maintaining this distribution line ceases at a meter box at the vicinity of Ascol Drive. The distribution line continues north until it enters the main base and stops at the Bulk Fuel Storage Area.

Supposedly, sometime in 1990, the City of Fort Worth was performing boring operations in Farmers Branch Creek near the main entrance to the base. They reported strong odors of fuel as they collected their samples. The base reported these odors to the pipeline owner. The pipeline owner supposedly conducted pressure tests and found the distribution line to be tight. Currently, there are no records of the borings nor the pressure tests to confirm these findings. The Air Force Base Conversion Agency (AFBCA) wishes to investigate this area to confirm the presence or absence and nature and extent of contamination. AFBCA has labeled this site on the DD Form 1391 as being the "RV parking area (Fam Camp)."

2.0 APPLICABLE DOCUMENTS

2.1 HANDBOOK

The "HQ AFCEE Handbook for the Installation Restoration Program (IRP) Remedial Investigations and Feasibility Studies (RI/FS)," September 1993, hereafter referred to as the "Handbook", provides guidelines for laboratory and field activities and applicable formats for project documents. Additional Guidance is provided by the draft Model Quality Assurance Project Plan. Where there is a conflict in guidance, the Model Quality Assurance Project Plan takes precedence.

2.2 COMPLIANCE DOCUMENTS

The Contractor shall comply with all federal, state, and local regulatory agency requirements and applicable statutes, policies, and regulations, including the most current version of the applicable portions of the documents listed in paragraph 2.2 of the basic contract SOW.

2.3 GUIDANCE DOCUMENTS

The documents listed in paragraph 2.3 of the basic contract SOW are incorporated by reference herein as guidance. More specifically, the Contractor shall utilize the most current and applicable Model Quality Assurance Project Plan (boilerplate to be provide in magnetic media under separate cover).

2.4 BASE-SPECIFIC DOCUMENTS

The Contractor shall be responsible for obtaining any base-specific documents through the base POC that may assist the Contractor in accomplishing the scope of work. The following base/site-specific documents have been specifically identified as applicable to this SOW.

a. The Comprehensive Plan of the Liquid Fuel System at NAS Fort Worth, dated May 1986 (blueprint).

3.0 GENERAL REQUIREMENTS

3.1 MEETINGS, CONFERENCES, AND SITE VISITS

3.1.1 Postaward Meeting. After the issuance of this DO, the Contractor shall attend a postaward meeting at the base or other location specified by the Contracting Officer's Representative (COR). The purpose of the meeting shall be to familiarize the Contractor with the work and/or hazardous waste sites addressed under this DO.

3.1.2 Progress Meetings. The Contractor shall attend approximately three progress meetings with the base and the Air Force Center for Environmental Excellence (AFCEE). No more than two Contractor personnel are required to attend each meeting. The meetings shall occur through the completion of this DO.

3.1.3 Design Integration Meetings. Not applicable to this DO.

3.1.4 Public Meetings. Not applicable to this DO.

3.2 SPECIAL NOTIFICATION

3.2.1 Health Risks. The Contractor shall immediately report to the COR, via telephone, any data or results generated during investigations pursuant to this DO that might indicate any potential imminent health risk to contracted or federal personnel, or the public at large. Following this telephone notification, a written notice with supporting documentation shall be prepared and delivered within three (3) working days. Upon request of the Air Force, the Contractor shall provide pertinent raw laboratory data (e.g., chromatograms) within three (3) weeks of the telephone notification.

3.2.2 Change of Contractor Personnel. An organizational chart displaying key personnel involved in the effort and their respective labor categories shall be submitted with the first monthly Status Report. The Contractor shall notify the COR of all professional personnel to work on specific tasks under this DO. The Contractor shall notify the COR of any significant changes in project personnel, along with the steps that the Contractor is taking to ensure there are no impacts to the schedule or costs associated with individual tasks. The Contractor shall also identify to the COR all subcontractors to be used under this DO prior to work being initiated. The Contractor shall provide information about the qualifications of the subcontractors to the COR prior to utilization. (A001AA)

3.3 LABORATORIES

3.3.1 **General.** Laboratories used by the Contractor may be subject to on-site audits by AFCEE. All laboratories shall be capable of meeting Data Quality Objectives (DQOs) specified in the approved project-specific Sampling and Analysis Plans (SAPs). The laboratories shall screen for analytes and perform Quality Assurance/Quality Control (QA/QC) requirements as specified in the SAPs. All analyses shall be reported on a dry weight basis to facilitate comparison with the off-site laboratory data. The analytical capabilities of the laboratory shall be sufficient for the methods specified in the SAP, and the laboratory shall have sufficient throughput capacity to handle the necessary analytical load during all field activities.

3.3.2 **On-Site Laboratories.** Not applicable to this DO.

3.3.3 **Preliminary Laboratory Review Packages.** For laboratories that have not been previously endorsed by AFCEE, the Contractor shall submit a preliminary laboratory review package to AFCEE/ERC describing the information listed below for each laboratory to be used. This information will facilitate future laboratory review by the government. Prior approval of the laboratory is not a prerequisite to its use. (A035)

a. Laboratory-derived method detection limits, including data used for the calculations. One data set shall be sent for each applicable method (not each instrument, if more than one instrument is being used per method).

b. A full set of acceptance criteria for recovery of surrogate standards and spikes, including the data used to make the calculations. One data set shall be sent for each applicable method (not each instrument, if more than one instrument is being used for a particular type of analysis).

c. Instrument calibration curves for each applicable analytical method.

d. A copy of the laboratory's Quality Assurance Manual.

e. Performance evaluation results for the past two years.

3.4 WORKSITE REQUIREMENTS

3.4.1 **Safety Requirements.** The Contractor shall provide for protecting the lives and health of employees and other persons; preventing damage to property, materials, supplies, and equipment; and avoiding work interruptions. For these purposes, the Contractor shall comply with Occupational Safety and Health Administration (OSHA) safety and health regulations.

3.4.2 **Worksite Maintenance.** The worksite shall be maintained as recommended in the Handbook so as to 1) prevent the spread of contamination, 2) provide for the integrity of the samples obtained, and 3) provide for the safety of federal workers, contracted personnel, and/or other individuals in the vicinity of the project areas.

The worksite shall be well marked to prevent inadvertent entry into all work areas. Access to work areas shall be monitored and thoroughly controlled. Standard work zones and access points for hazardous waste operations shall be established and maintained as the site conditions warrant. The Contractor shall, at all times, keep the work area free from accumulation of waste materials. The Contractor shall remove nonessential equipment from the worksite when not in use. The worksite shall be maintained to present an orderly appearance and to maximize work efficiency.

Before completing the work at each sampling site, the Contractor shall remove from the work premises any rubbish, tools, equipment, and materials that are not property of the government. Upon completing the work, the Contractor shall leave the area clean, neat, and orderly and return worksites to the original condition. The Contractor shall also ensure compliance with any federal and state regulations for decontaminating tools, equipment, or other materials as required.

The Contractor shall be responsible for the handling, temporary storage, characterization, permitting, manifesting, transportation, and disposal of all investigation-derived wastes, including drilling fluids and cuttings, excavation material, storage containers, well development and purge water, personal protective equipment and decontamination-related solids and liquids.

3.4.3 Operations Impact Minimization. The Contractor shall mark the field locations of all points of ground penetration during the planning/mobilization phase of the field investigation. The base Point of Contact (POC) shall be consulted to properly position sampling locations (wells, borings, soil gas probes, etc.) with respect to site locations, to minimize the disruption of base activities, and to avoid penetrating underground utilities. Additionally, the Contractor may be required to coordinate with other base personnel to attain these objectives. The Contractor shall provide for the detection of underground utilities independent of base Civil Engineering services utilizing geophysical or other techniques. All necessary permits shall be obtained, and necessary coordination shall be completed, prior to commencement of individual sampling operations. Frequent communication and coordination with base personnel shall be necessary to accomplish these goals.

3.4.4 Storage. The Contractor shall be responsible for the security of his equipment. Equipment or materials that require storage on base shall be placed at sites as designated by the base POC. The Contractor shall be responsible for security and weatherproofing of any stored material and equipment. Missing or damaged material shall be replaced at no additional cost to the government. At the completion of the work, all temporary fences and structures that the Contractor used to protect materials and equipment shall be removed from the base. The Contractor shall clean the storage area of all debris and material and perform all repairs as required to return the site to its original condition.

3.4.5 Security. The Contractor is responsible for obtaining and monitoring Contractor security badges for all areas for the duration of this contract. All security badges or passes shall be returned to the base POC upon expiration of the badge, upon completion of the project, or when possession of the badge is no longer necessary (e.g., upon removal of contracted personnel from specific projects). Photography of any kind must be coordinated through the base POC or Base Conversion Agency representative.

3.5 WORK BREAKDOWN STRUCTURE

The Contractor shall prepare proposals, project schedules, and monthly financial reports organized according to the following work breakdown structure (WBS):

5 SITE ASSESSMENT/SITE INVESTIGATION (SA/SI)

- 5.01 SA/SI Scoping
- 5.02 Site Assessment
- 5.03 Soil Borings
- 5.04 Groundwater Monitoring Wells
- 5.05 Sampling and Analysis
- 5.06 Recommendations

10 SITE CHARACTERIZATION (SC)

- 10.01 SC Scoping
- 10.02 Not applicable to this DO
- 10.03 Site Characterization
- 10.04 Not applicable to this DO
- 10.05 Not applicable to this DO
- 10.06 Not applicable to this DO
- 10.07 Not applicable to this DO
- 10.08 Groundwater Monitoring Wells
- 10.09 Sampling and Analysis
- 10.10 Site Work and Utilities

4.0 WORK TASKS

4.1 DELIVERY ORDER SCOPING AND PLAN DEVELOPMENT

4.1.1 Presurvey. The Contractor shall conduct presurveys to enable preliminary scoping of environmental issues. The Contractor shall visit the assigned site(s) and make all preliminary studies of monitoring or sampling locations and accessibility, number of sampling locations, number and type of personnel required, number and type of tests or samples desired, special or modified sampling equipment and procedures required, personal protective equipment required, and type of analytical protocol or procedures to ensure that the survey activities shall comply with applicable regulations, laws, or standards.

4.1.2 Premobilization Survey. The Contractor shall determine, by registered land surveyor, any locations of off-base drilling easements. Prior to performing any off-base fieldwork or drilling any off-base wells, the Contractor shall conduct a survey to determine the closest property line. After wells have been installed, the Contractor shall locate easements from the closest property line and establish permanent easement boundaries. The Contractor shall provide a metes and bounds description and plot plan for each easement site.

4.1.3 Plan Development. The Contractor shall prepare a project/site-specific Work Plan (WP) and a Quality Program Plan (QPP) that includes a Health and Safety Plan (HSP) and a SAP. The SAP shall consist of a Field Sampling Plan (FSP) and a Quality Assurance Project Plan (QAPP). In the development of these plans, the Contractor shall make practical use of the Model Quality Assurance Project Plan and previously approved plans. The Model Quality Assurance Project Plan is a boilerplate document available on magnetic media (3.5" diskette) and will be supplied under separate cover or upon request. The CO, AFCEE COR, and base POC shall be notified in writing of any proposed modification or deviation of any activity described in these documents.

4.1.3.1 **Quality Program Plans.** The Contractor shall develop a QPP which will consist of the following:

4.1.3.1.1 **Health and Safety Plan.** The Contractor shall prepare and deliver a HSP to comply with Air Force, OSHA, EPA, state, and local health and safety regulations regarding the proposed work effort. The Contractor shall utilize to the fullest extent possible existing corporate HSPs, tailoring them to the current effort. The Contractor shall use EPA guidelines for designating the appropriate levels of protection needed at the study sites. The Contractor shall coordinate the HSP directly with applicable regulatory agencies prior to submittal to AFCEE and provide the COR with evidence of HSP coordination prior to the start of fieldwork. The Contractor shall certify to AFCEE that it has reviewed the approved HSP with each employee and subcontractor's employees prior to the time each employee engages in field activities. In the development of these plans, the Contractor shall make practical use of the Model Quality Assurance Project Plan and previously approved plans. The Model Quality Assurance Project Plan is a boilerplate document available on magnetic media (3.5" diskette) and will be supplied under separate cover or upon request. (A002)

4.1.3.1.2 **Sampling and Analysis Plan.** The SAP shall consist of addendum's to the previously approved SAP for NAS Fort Worth (provided under separate cover) using the Handbook as guidance. Addendum's shall address both the FSP and the QAPP. In the development of these plans, the Contractor shall make practical use of the Model Quality Assurance Project Plan and previously approved plans. The Model Quality Assurance Project Plan is a boilerplate document available on magnetic media (3.5" diskette) and will be supplied under separate cover or upon request.. (A003)

4.1.3.2 **Work Plans.** The Contractor shall deliver a Work Plan for all phases of work specified in this DO to include plans for disposing of the investigative-derived waste. The Contractor shall use the Handbook as Guidance. (A004)

4.1.3.3 Management Action Plan. Not applicable to this DO.

4.1.3.4 Community Relations Plan. Not applicable to this DO.

4.1.3.5 Environmental and Land Use Plan. Not applicable to this DO.

4.2 SITE ASSESSMENT/SITE INVESTIGATION

The Contractor shall conduct a SA/SI to define the environmental setting of NAS Fort Worth, TX, to identify preliminary sites that might potentially be contaminated, and to develop a site assessment of the potential sources of contamination. The Contractor shall be required to travel to NAS Fort Worth, TX, and make all preliminary studies of monitoring or sampling locations and accessibility, number of sampling locations, number and type of personnel required, number and type of tests or samples desired, special or modified sampling equipment and procedures required, personnel protective equipment required, and type of analytical protocol or procedures to ensure that activities shall comply with EPA or state National Pollutant Discharge Elimination System (NPDES) regulations or other laws, regulations, and standards that are applicable.

4.2.1 Site Assessment. The Contractor shall conduct a SA to define the environmental setting of the Fam Camp Area (as defined in the scope) and to identify potentially contaminated areas and potential sources of contaminants. The ultimate goals of the SA are to 1) identify all potentially contaminated areas, 2) identify areas that require emergency response, and 3) develop a conceptual site model for the Fam Camp Area, presenting hypotheses regarding the contaminants present, their potential migration pathways, and their potential impact on sensitive receptors. Guidelines for the conceptual site model are given in the Handbook. Sources of information include federal, state, and local agencies, base personnel and former employees, aerial photographs, academic institutions, and reports of previous investigations. The Contractor shall document the findings and recommendations in a SA report using the guidance in OSWER directive 9345.0-01 and the outline in the Handbook. All references, personal communications, and so forth shall be cited in an appendix to the report.

4.2.2 Site Investigation. The Contractor shall visit the Fam Camp Area to ensure a complete understanding of site conditions, and shall coordinate this visit with the COR. The Contractor shall visit and inspect the site identified in the SA report. The Contractor shall look for evidence of contamination at this site (leaking drums, vegetative stress, leachate seeps, etc.). The Contractor shall observe the physical setting of this site to formulate specific recommendations concerning well and boring placement, use of geophysical techniques, and other aspects of the proposed field investigation. The Contractor shall document the findings in a SI Report using the outline in the Handbook. The findings of the presurvey shall be used to prepare the work plan and SAP required for the follow-up effort.

4.2.3 Site Assessment/Site Investigation Report. The Contractor shall deliver a report documenting the results of the SA/SI. This report shall include the results of the literature search, describing the environmental setting of the base and identifying potential sources of contamination. The report shall also document the results of all site investigations conducted. (A007)

4.3 SITE CHARACTERIZATION

4.3.1 Site Characterization. The Contractor shall conduct a SC to characterize environmental conditions, define the nature and extent of contamination, and quantitatively estimate the risk to human health and the environment at various sites through the collection of geologic, geophysical, hydrogeological, ecological, chemical, physical, and hydrologic data, and environmental samples; the laboratory analysis of those samples for potential contaminants; the evaluation of the analytical results and field measurements with respect to quality control data; and the interpretation and analysis of validated data. The purpose of data collection, sample collection, and laboratory analysis is to determine whether any contaminants generated from installation activities have entered the environment and pose a risk to human health or the environment. The samples obtained from the SA/SI effort shall be utilized for the SC effort.

The field investigation is used to determine the source of any identified contaminants, the magnitude of contamination relative to Applicable or Relevant and Appropriate Requirements (ARARs), and any naturally occurring or background concentrations for specific compounds. The SC shall comply with the specifications, procedures, and methodologies presented in the approved project-specific SAP.

4.3.1.1 Site Characterization Report. The Contractor shall prepare the Site Characterization Report in accordance with OSWER 9355.3-01, "Guidance for Conducting Remedial Investigation and Feasibility Studies under CERCLA," October 1988. The reports shall include conceptual site models and results of the baseline risk assessment, and shall reflect regulatory agency comments to the corresponding Site Characterization Summaries (SCSs). (A008)

4.3.1.2 Informal Technical Information Reports (ITIRs)

4.3.1.2.1 Analytical Data ITIR. The Contractor shall submit all analytical data, including QC results and cross-reference tables, in a hard and/or electronic copy ITIR, using the format in Section 3 of the Handbook. (A009)

4.3.1.2.2 Accelerated Remediation Project Definition ITIR. If contamination is discovered, the Contractor shall request CO approval to deliver a Project Definition ITIR on a case by case basis. Prior to preparation of this document, the Contractor shall submit an annotated outline for content and format approval by the AFCEE CO. This document shall contain at a minimum a SCS and all available qualitative and quantitative information necessary to define requirements for site remediation (construction and linear footage of piping associated with storage tanks, volume of contaminated soil, etc.). (A010)

4.3.1.2.3 Site Characterization Summary-ITIR. Guidance for the contents and objectives of a SCS-ITIR may be found in the Handbook. The SCS-ITIRs shall serve as core documents for the SC reports. The Contractor shall submit an annotated outline of each section of the ITIRs, prior to preparation. The Contractor shall prepare the reports as specified in the accepted annotated outlines. The Contractor shall submit newly revised portions of the working copy ITIR in order to make available current site characterization data. A prime objective shall be to incorporate any comments into the report in an ongoing fashion in coordination with the COR and the base POC in order to minimize the volume of comments on the working copy and final submittals. The final summary shall contain all sites included in the effort. The Contractor shall prepare the reports to include the following components: (A011)

a. Source identification and contaminant delineation

b. Identification and ranking of appropriate treatability studies for listed sites

c. Data and interpretations integrating the findings of the current study and all previous SC efforts at the sites

d. Current iso-concentration plots of contaminants detected at each site, lithographs of each boring showing contaminants detected and relationship to other borings in the site, and cross-sections of the site showing contaminant distribution.

4.3.2 Feasibility Study. Not applicable to this DO.

4.4 REMEDIAL DESIGN. Not applicable to this DO.

4.5 TREATABILITY STUDIES, PILOT TESTS, AND BENCH-SCALE TESTS. Not applicable to this DO.

4.6 SUBTASKS

Subtasks shall include the following:

4.6.1 Conceptual Site Model (CSM). For the Fam Camp Area, the Contractor shall use validated data supported by acceptable QA/QC results (as measured against QAPP requirements) and site characterization information to develop or refine, based on newly collected data, the CSM. The model shall define the nature and extent of contamination, the hydrogeologic regime, and the transport and fate of those contaminants. The Handbook provides guidance in completing CSMs. The complexity and detail of the site model shall be consistent with the nature of the site and site problems and the amount of data available. The CSM shall be used in the baseline risk assessment. (A025)

4.6.2 Ecological/Baseline Risk Assessment. For the Fam Camp Area, the Contractor shall use validated data supported by acceptable QA/QC results (as measured against QAPP requirements) and the CSM to estimate numerically the risk posed by site contaminants to public health and the environment. The Handbook provides guidance in completing conceptual risk assessments. The Contractor shall identify all ARARs that were not identified in previous reports for those contaminants detected in environmental samples at each site. The Contractor shall provide the results of the baseline and/or ecological risk assessment in the SC using the Handbook as guidance. (A026)

The Contractor shall identify those sites posing minimal or no threat to human health, welfare, or the environment and for which no further action is appropriate.

4.6.3 Alternatives Development. Not applicable to this DO.

4.6.4 Alternatives Analysis. Not applicable to this DO.

4.6.5 Evaluation of Remedial Systems and Environmental Equipment. Not applicable to this DO.

4.6.6 Administrative Record. Not applicable to this DO.

4.7 OTHER ENVIRONMENTAL ACTIVITIES. Not applicable to this DO.

4.8 MISCELLANEOUS DELIVERABLES

4.8.1 Monthly Financial and Management Reports. The Contractor shall submit financial and management reports utilizing the standardized WBS to describe the status of expenditure of funds correlated with the progress of the work completed. Reports shall provide current status and projected requirements of funds, man-hours, and work completion; indicate the progress of work and the status of the program and assigned tasks; and inform of existing or potential problem areas. (B006, B007, A001AB)

4.8.2 Project Schedules. The Contractor shall deliver a computer-generated network analysis that is a detailed task plan for all WBS tasks for approval by the COR. The Network Analysis (e.g., Gantt, PERT, CPM) shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period of the DO. The Network Analysis shall show both serial and parallel subtasks leading to a deliverable product/report, and shall show early and late start and completion date with float. (B001)

4.8.3 Installation Restoration Program Information Management System (IRPIMS) Data Management. The Contractor shall meet the data deliverable requirements of the IRPIMS. The Contractor shall be responsible for recording field and laboratory data into a computerized format as required by the most current version of the IRPIMS Data Loading Handbook (mailed under separate cover). To perform this task, the Contractor shall use the latest version of the IRPIMS QC Tool, a PC software utility (mailed under separate cover with software manual), to quality check ASCII data files and to check all data files for compliance with requirements in the IRPIMS Data Loading Handbook. The IRPIMS Contractor Data Loading Tool (CDLT) is available on request. This PC software is designed to assist the Contractor in preparing the various ASCII data files.

Individual IRPIMS data files (analytical results, groundwater level data, etc.), including resubmissions, shall be delivered with a transmittal letter by the Contractor to AFCEE in sequence according to a controlled time schedule as identified in the current version of the IRPIMS Data Loading Handbook. The Contractor shall include a copy of the QC Tool error report (i.e., output from the QC Tool) for each IRPIMS file submission. The error report shall be submitted as hard copy with the transmittal letter. (B003)

All Contractor data deliverables shall be sent to:
AFCEE/MSC BLDG 532
Environmental Systems Support Team
ATTN: IRPIMS Data Management
3207 North Road
Brooks AFB, TX 78235-5363

In addition, the Contractor shall provide a copy of the transmittal letter to HSC/PKVCC. This letter shall identify the files included or otherwise omitted (with an appropriate explanation), the government contract and DO number. The Contractor shall be responsible for the accuracy and completeness of all data submitted. All data entered into the IRPIMS data files and submitted by the Contractor shall correspond exactly with the data contained in the original laboratory reports and other documents associated with sampling and laboratory contractual tasks. Each file delivered by the Contractor will be electronically evaluated by AFCEE/MSC for format compliance and data integrity in order to verify acceptance. All files delivered by the Contractor are required to be in compliance with the IRPIMS Data Loading Handbook. Any errors identified by AFCEE/MSC in the submission shall be corrected by the Contractor.

4.8.4 Presentation Materials. The Contractor shall prepare and present briefing packages at meetings coordinated by the Air Force. As part of the presentation materials, the Contractor shall deliver paper copies of all slides and overheads. (B004)

4.8.5 Photo Documentation. The Contractor shall deliver photo documentation as necessary to support other deliverables. Documentation should include photos of sites under investigation, field activities, and sample locations. (A031)

4.8.6 Meeting Minutes. The Contractor shall be responsible for generating meeting minutes documenting all items discussed at the meetings, and shall include a list of meeting attendees. (B005)

5.0 DATA MANAGEMENT

The Contractor shall collect, prepare, publish, and distribute the data in the quantities and types designated on the Contract Data Requirements List (CDRL). The Contractor shall designate a focal point who shall integrate the total data management effort and manage changes, additions, or deletions of data items. In addition, the Contractor shall identify items to be added, recommend revisions or deletion of items already listed on the CDRL as appropriate, and maintain the status of all data deliverables.

6.0 GOVERNMENT-FURNISHED PROPERTY

Provided under separate cover.

7.0 GOVERNMENT POINTS OF CONTACT

AFCEE/ERB
Team Chief (TC)
Mr. Charles Rice
AFCEE/ERB
3207 North Road, Bldg 532
Brooks AFB, TX 78235-5363
Office Phone # (210) 536-6452
Fax Phone # (210) 536-3609

Base POC
AFBCA Site Manager
Mr. Olen Long, P.E.
AFBCA/OL-H
6550 White Settlement Road
Fort Worth, Texas 76114-3520
Office Phone # (817) 731-8284
Fax Phone # (817) 731-8137

CONTRACT DATA REQUIREMENTS LIST
(1 Data Item)

Form Approved
OMB NO. 0704-0188

A. CONTRACT LINE ITEM NO.: 0005
B. EXHIBIT: A
C. CATEGORY: TDP ____ TM ____ OTHER MGMT

D. SYSTEM/ITEM: PA/SI/RI/FS/RD CONTRACTS
E. CONTRACT/PR NO.: F41624-95-D-8002/0003/00
F. CONTRACTOR: The Environmental Co.

1. DATA ITEM NO.: A001AA
2. TITLE OF DATA ITEM: STATUS REPORT
3. SUBTITLE: CONTRACTOR PERSONNEL

4. AUTHORITY (DATA ACQUISITION DOC NO.): DI-MGMT-80368
5. CONTRACT REFERENCE: SOW PARA 3.2.2
6. REQUIRING OFFICE: AFCEE/ERB

7. DD 250 REQ: LT
8. APP CODE: N/A
9. DIST STATEMENT REQUIRED: A
10. FREQ: ONE/R
11. AOD: BLOCK 16
12. DATE OF FIRST SUB: BLOCK 16
13. DATE OF SUBSEQ SUB: BLOCK 16

14. DISTRIBUTION

a. ADDRESSEE	b. COPIES Draft	Final Reg	Final Repro
AFCEE/ERB	0	1	0
AFCEE/ERS	0	LT	1
HSC/PKVCC	0	LT	0
DCMAO/ACO	0	LT	0
AFBCA/OL-H	0	1	0
AFCEE/ERSC	0	1	0
SEE BLOCK 16			
15. TOTAL ---->	0	3	1

16. REMARKS

Block 4: DID tailoring: Delete paragraph 10.2.2.3.

Block 11: Provide the date of preparation.

Blocks 12 & 13: Submit the initial chart thirty (30) calendar days after the effective date of the delivery order. Subsequent reports shall be submitted in accordance with paragraph 3.2.2 of the SOW.

Block 14: Reproducible copy shall be magnetic media delivered on a 3.5 inch diskette in IBM compatible format.

G. PREPARED BY: AFCEE/ERS
H. DATE: 24-JAN-96
I. APPROVED BY: CHARLES RICE, AFCEE/ERB
J. DATE: 24-JAN-96

17. PRICE GROUP: N/A
18. ESTIMATED TOTAL PRICE: NSP

Page 1 of 1 Pages

CONTRACT DATA REQUIREMENTS LIST
(1 Data Item)

Form Approved
OMB NO. 0704-0188

A. CONTRACT LINE ITEM NO.: 0005
B. EXHIBIT: A
C. CATEGORY: TDP ____ TM ____ OTHER MGMT

D. SYSTEM/ITEM: PA/SI/RI/FS/RD CONTRACTS
E. CONTRACT/PR NO.: F41624-95-D-8002/0003/00
F. CONTRACTOR: The Environmental Co.

1. DATA ITEM NO.: A001AB
2. TITLE OF DATA ITEM: STATUS REPORT
3. SUBTITLE: N/A

4. AUTHORITY (DATA ACQUISITION DOC NO.): DI-MGMT-80368
5. CONTRACT REFERENCE: SOW PARA 4.8.1
6. REQUIRING OFFICE: AFCEE/ERB

7. DD 250 REQ: LT
8. APP CODE: N/A
9. DIST STATEMENT REQUIRED: A
10. FREQ: MTHLY
11. AOD: BLOCK 16
12. DATE OF FIRST SUB: BLOCK 16
13. DATE OF SUBSEQ SUB: BLOCK 16

14. DISTRIBUTION

a. ADDRESSEE	b. COPIES Draft	Final Reg	Final Repro
AFCEE/ERB	0	1	
AFCEE/ERS	0	LT	
HSC/PKVCC	0	LT	
DCMAO/ACO	0	LT	
AFCEE/ERSC	0	1	
AFBCA/OL-H	0	1	
SEE BLOCK 16			
15. TOTAL ---->	0	3	

16. REMARKS

Block 4: DID tailoring: Delete paragraph 10.2.2.3.

Block 11: Provide the date of preparation.

Blocks 12 & 13: Submit the initial report thirty (30) calendar days after the effective date of the Delivery Order or the end of the contractor's first cost accounting period whichever occurs first. Subsequent reports shall be monthly thereafter.

Block 14: Reproducible copy shall be magnetic media delivered on a 3.5 inch diskette in IBM compatible format.

G. PREPARED BY: AFCEE/ERS
H. DATE: 24-JAN-96
I. APPROVED BY: Charles A. Rice
CHARLES RICE, AFCEE/ERB
J. DATE: 24-JAN-96

17. PRICE GROUP: N/A
18. ESTIMATED TOTAL PRICE: NSP

Page 1 of 1 Pages

379 68

CONTRACT DATA REQUIREMENTS LIST (1 Data Item)	Form Approved OMB NO. 0704-0188

Public reporting burden for this collection of information is estimated to average 110 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden, estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Services, Directorate for Information and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503. Please DO NOT RETURN your form to either of these addresses. Send completed form to the Government Issuing Contracting Officer for the Contract/PR NO listed in Block E.

A. CONTRACT LINE ITEM NO. 0005	B. EXHIBIT A	C. CATEGORY: TDP ___ TM ___ OTHER ENVR
D. SYSTEM/ITEM PA/SI/RI/FS/RD CONTRACTS	E. CONTRACT/PR NO. F41624-95-D-8002/0003/00	F. CONTRACTOR The Environmental Co.
1. DATA ITEM NO. A002	2. TITLE OF DATA ITEM ENVIRONMENTAL HEALTH AND SAFETY PLAN (HSP)	3. SUBTITLE N/A
4. AUTHORITY (DATA ACQUISITION DOC NO.) DI-ENVR-81375	5. CONTRACT REFERENCE SOW PARA 4.1.3.1.1	6. REQUIRING OFFICE AFCEE/ERB

7. DD 250 REQ LT	9. DIST STATEMENT REQUIRED A	10. FREQ ASREQ	12. DATE OF FIRST SUB BLOCK 16
8. APP CODE A		11. AOD N/A	13. DATE OF SUBSEQ SUB BLOCK 16

16. REMARKS

Blocks 12 & 13: Submit in accordance with the approved project schedule. The Contractor shall incorporate any government comments and submit the final in accordance with the approved project schedule.

Block 14: Reproducible shall be magnetic media delivered on 3.5 inch diskette, in IBM-compatible format.

14. DISTRIBUTION

a. ADDRESSEE	b. COPIES Draft	Final Reg	Final Repro
AFCEE/ERB	5	7	1
AFCEE/ERS	LT	LT	1
HSC/PKVCC	0	LT	0
DCMAO/ACO	0	LT	0
AFBCA/OL-H	1	1	0
SEE BLOCK 16			
15. TOTAL ---->	6	8	2

G. PREPARED BY AFCEE/ERS	H. DATE 24-JAN-96	I. APPROVED BY CHARLES RICE, AFCEE/ERB	J. DATE 24-JAN-96
17. PRICE GROUP N/A	18. ESTIMATED TOTAL PRICE NSP		Page 1 of 1 Pages

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CONTRACT DATA REQUIREMENTS LIST
(1 Data Item)

Form Approved
OMB NO. 0704-0188

A. CONTRACT LINE ITEM NO. 0005	B. EXHIBIT A	C. CATEGORY: TDP ____ TM ____ OTHER ENVR
D. SYSTEM/ITEM PA/SI/RI/FS/RD CONTRACTS	E. CONTRACT/PR NO. F41624-95-D-8002/0003/00	F. CONTRACTOR The Environmental Co.
1. DATA ITEM NO. A003	2. TITLE OF DATA ITEM ENVIRONMENTAL SAMPLING AND ANALYSIS PLAN (SAP)	3. SUBTITLE SAP WITH FSP & QAPP
4. AUTHORITY (DATA ACQUISITION DOC NO.) DI-ENVR-81374	5. CONTRACT REFERENCE SOW PARA 4.1.3.1.2	6. REQUIRING OFFICE AFCEE/ERB

7. DD 250 REQ LT	9. DIST STATEMENT REQUIRED A	10. FREQ ONE/R	12. DATE OF FIRST SUB BLOCK 16
8. APP CODE A		11. AOD N/A	13. DATE OF SUBSEQ SUB BLOCK 16

16. REMARKS

Block 10: Revise to incorporate AFCEE/ERB comments and thereafter to incorporate Air Force approved updates.

Blocks 12 & 13: Submit Draft and Final reports in accordance with the approved project schedule. The government will require sixty (60) days for review of Draft and thirty (30) days for review of Final. The Contractor shall incorporate any government comments and submit a final report within thirty (30) days after receipt of government comments/approval.

Block 14: Reproducible shall be magnetic media delivered on 3.5 inch diskette, in IBM-compatible format.

The Handbook for the Installation Restoration Program (IRP), Remedial Investigations and Feasibility Studies (RI/FS) may be used as guidance for the plans.

14. DISTRIBUTION

a. ADDRESSEE	b. COPIES Draft	Final Reg	Final Repro
AFCEE/ERB	5	7	
AFCEE/ERS	LT	LT	
HSC/PKVCC	0	LT	
DCMAO/ACO	0	LT	
AFBCA/OL-H	1	1	
SEE BLOCK 16			
15. TOTAL ---->	6	8	

G. PREPARED BY AFCEE/ERS	H. DATE 24-JAN-96	I. APPROVED BY Charles Rice CHARLES RICE, AFCEE/ERB	J. DATE 24-JAN-96
17. PRICE GROUP N/A	18. ESTIMATED TOTAL PRICE NSP		Page 1 of 1 Pages

CONTRACT DATA REQUIREMENTS LIST
(1 Data Item)

Form Approved
OMB NO. 0704-0188

A. CONTRACT LINE ITEM NO.	B. EXHIBIT	C. CATEGORY:
0005	A	TDP ____ TM ____ OTHER MISC

D. SYSTEM/ITEM	E. CONTRACT/PR NO.	F. CONTRACTOR
PA/SI/RI/FS/RD CONTRACTS	F41624-95-D-8002/0003/00	The Environmental Co.

1. DATA ITEM NO.	2. TITLE OF DATA ITEM	3. SUBTITLE
A004	TECHNICAL REPORT - STUDY/SERVICES	WORK PLAN

4. AUTHORITY (DATA ACQUISITION DOC NO.)	5. CONTRACT REFERENCE	6. REQUIRING OFFICE
DI-MISC-80508	SOW PARA 4.1.3.2	AFCEE/ERB

7. DD 250 REQ	9. DIST STATEMENT REQUIRED	10. FREQ	12. DATE OF FIRST SUB
LT		ONE/R	BLOCK 16
8. APP CODE		11. AOD	13. DATE OF SUBSEQ SUB
A	A	N/A	BLOCK 16

14. DISTRIBUTION

a. ADDRESSEE	b. COPIES Draft	Final Reg	Final Repro
AFCEE/ERB	5	7	1
AFCEE/ERS	LT	LT	1
HSC/PKVCC	0	LT	0
DCMAO/ACO	0	LT	0
AFBCA/OL-H	1	1	0
SEE BLOCK 16			
15. TOTAL ---->	6	8	2

16. REMARKS

Block 10: Revise to incorporate AFCEE/ERB comments and thereafter to incorporate Air Force approved updates.

Blocks 12 & 13: Submit Draft and Final reports in accordance with the approved project schedule. The government will require sixty (60) days for review of Draft and thirty (30) days for review of Final. The Contractor shall incorporate any government comments and submit a final report within thirty (30) days after receipt of government comments/approval.

Block 14: Reproducible shall be magnetic media delivered on 3.5 inch diskette, in IBM-compatible format.

The Handbook for the Installation Restoration Program (IRP), Remedial Investigations and Feasibility Studies (RI/FS) may be used as guidance for the plan.

G. PREPARED BY	H. DATE	I. APPROVED BY	J. DATE
AFCEE/ERS	24-JAN-96	Charles Rice CHARLES RICE, AFCEE/ERB	24-JAN-96

17. PRICE GROUP	18. ESTIMATED TOTAL PRICE	
N/A	NSP	Page 1 of 1 Pages

CONTRACT DATA REQUIREMENTS LIST
(1 Data Item)

Form Approved
OMB NO. 0704-0188

A. CONTRACT LINE ITEM NO.: 0005
B. EXHIBIT: A
C. CATEGORY: TDP ____ TM ____ OTHER MISC
D. SYSTEM/ITEM: PA/SI/RI/FS/RD CONTRACTS
E. CONTRACT/PR NO.: F41624-95-D-8002/0003/00
F. CONTRACTOR: The Environmental Co.
1. DATA ITEM NO.: A007
2. TITLE OF DATA ITEM: TECHNICAL REPORT - STUDY/SERVICES
3. SUBTITLE: PRELIMINARY ASSESSMENT/SITE INVESTIGATION REPORT
4. AUTHORITY (DATA ACQUISITION DOC NO.): DI-MISC-80508
5. CONTRACT REFERENCE: SOW PARA 4.2.3
6. REQUIRING OFFICE: AFCEE/ERB
7. DD 250 REQ: LT
8. APP CODE: A
9. DIST STATEMENT REQUIRED: A
10. FREQ: ONE/R
11. AOD: N/A
12. DATE OF FIRST SUB: BLOCK 16
13. DATE OF SUBSEQ SUB: BLOCK 16

14. DISTRIBUTION

a. ADDRESSEE	b. COPIES Draft	Final Reg	Final Repro
AFCEE/ERB	5	7	
AFCEE/ERS	LT	LT	
HSC/PKVCC	0	LT	
DCMAO/ACO	0	LT	
AFBCA/OL-H	1	1	
SEE BLOCK 16			
15. TOTAL ---->	6	8	

16. REMARKS

Block 10: Revise to incorporate Air Force/ERB comments and thereafter to incorporate Air Force approved changes.

Blocks 12 & 13: Submit Draft and Final reports in accordance with the approved project schedule. The government will require sixty (60) days for review of Draft and thirty (30) days for review of Final. The Contractor shall incorporate any government comments and submit a final report within thirty (30) days after receipt of government comments/approval.

Block 14: Reproducible shall be magnetic media delivered on a 3.5 inch diskette in IBM-compatible format.

G. PREPARED BY: AFCEE/ERS
H. DATE: 24-JAN-96
I. APPROVED BY: Charles A. Rice
CHARLES RICE, AFCEE/ERB
J. DATE: 24-JAN-96
17. PRICE GROUP: N/A
18. ESTIMATED TOTAL PRICE: NSP

Page 1 of 1 Pages

CONTRACT DATA REQUIREMENTS LIST
(1 Data Item)

Form Approved
OMB NO. 0704-0188

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A. CONTRACT LINE ITEM NO. 0005	B. EXHIBIT A	C. CATEGORY: TDP ___ TM ___ OTHER MISC
D. SYSTEM/ITEM PA/SI/RI/FS/RD CONTRACTS	E. CONTRACT/PR NO. F41624-95-D-8002/0003/00	F. CONTRACTOR The Environmental Co.
1. DATA ITEM NO. A008	2. TITLE OF DATA ITEM TECHNICAL REPORT - STUDY/SERVICES	3. SUBTITLE REMEDIAL INVESTIGATION REPORTS
4. AUTHORITY (DATA ACQUISITION DOC NO.) DI-MISC-80508	5. CONTRACT REFERENCE SOW PARA 4.3.1.1	6. REQUIRING OFFICE AFCEE/ERB

7. DD 250 REQ LT	9. DIST STATEMENT REQUIRED A	10. FREQ ONE/R	12. DATE OF FIRST SUB BLOCK 16
8. APP CODE A		11. AOD N/A	13. DATE OF SUBSEQ SUB BLOCK 16

14. DISTRIBUTION

a. ADDRESSEE	b. COPIES Draft	Final Reg	Final Repro
AFCEE/ERB	5	7	1
AFCEE/ERS	LT	LT	0
HSC/PKVCC	LT	LT	0
DCMAO/ACO	LT	LT	0
AFBCA/OL-H	1	1	0
15. TOTAL ---->	6	8	1

16. REMARKS

Block 10: Revise to incorporate Air Force/ERB comments and thereafter to incorporate Air Force approved changes.

Blocks 12 & 13: Submit Draft and Final reports in accordance with the approved project schedule. The government will require sixty (60) days for review of Draft and thirty (30) days for review of Final. The Contractor shall incorporate any government comments and submit a final report within thirty (30) days after receipt of government comments/approval.

Block 14: Reproducible shall be magnetic media delivered on a 3.5 inch diskette in IBM-compatible format.

G. PREPARED BY AFCEE/ERS	H. DATE 24-JAN-96	I. APPROVED BY CHARLES RICE, AFCEE/ERB	J. DATE 24-JAN-96
17. PRICE GROUP N/A	18. ESTIMATED TOTAL PRICE NSP		Page 1 of 1 Pages

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CONTRACT DATA REQUIREMENTS LIST
(1 Data Item)

Form Approved
OMB NO. 0704-0188

A. CONTRACT LINE ITEM NO.: 0005
B. EXHIBIT: A
C. CATEGORY: TDP ____ TM ____ OTHER ENVR

D. SYSTEM/ITEM: PA/SI/RI/FS/RD CONTRACTS
E. CONTRACT/PR NO.: F41624-95-D-8002/0003/00
F. CONTRACTOR: The Environmental Co.

1. DATA ITEM NO.: A009
2. TITLE OF DATA ITEM: ENVIRONMENTAL ANALYTICAL DATA INFORMAL TECHNICAL INFORMATION REPORT (ITIR)
3. SUBTITLE: ENVIRONMENTAL ANALYTICAL DATA

4. AUTHORITY (DATA ACQUISITION DOC NO.): OT-94-34103
5. CONTRACT REFERENCE: SOW PARA 4.3.1.2.1
6. REQUIRING OFFICE: AFCEE/ERB

7. DD 250 REQ: LT
8. APP CODE: A
9. DIST STATEMENT REQUIRED: A
10. FREQ: ONE/R
11. AOD: BLOCK 16
12. DATE OF FIRST SUB: BLOCK 16
13. DATE OF SUBSEQ SUB: BLOCK 16

14. DISTRIBUTION

a. ADDRESSEE	b. COPIES Draft	Final Reg	Final Repro
AFCEE/ERB	5	7	
AFCEE/ERS	LT	LT	
HSC/PKVCC	0	LT	
DCMAO/ACO	0	LT	
AFBCA/OL-H	1	1	
SEE BLOCK 16			
15. TOTAL ---->	6	8	

16. REMARKS

Block 10: Revise to incorporate Air Force/ERB comments and thereafter to incorporate Air Force approved changes.

Block 11: Effective date of Delivery Order.

Blocks 12 & 13: Submit a report within fifteen (15) days after completion of screening/analysis. Assume thirty (30) days for review.

Block 14: Reproducible shall be magnetic media delivered on a 3.5 inch diskette in IBM-compatible format.

The Handbook for the Installation Restoration Program (IRP), Remedial Investigations and Feasibility Studies (RI/FS) may be used as guidance for the report.

G. PREPARED BY: AFCEE/ERS
H. DATE: 24-JAN-96
I. APPROVED BY: Charles Rice
CHARLES RICE, AFCEE/ERB
J. DATE: 24-JAN-96

17. PRICE GROUP: N/A
18. ESTIMATED TOTAL PRICE: NSP

Page 1 of 1 Pages

CONTRACT DATA REQUIREMENTS LIST
(1 Data Item)

Form Approved
OMB NO. 0704-0188

A. CONTRACT LINE ITEM NO.: 0005
B. EXHIBIT: A
C. CATEGORY: TDP ____ TM ____ OTHER MISC

D. SYSTEM/ITEM: PA/SI/RI/FS/RD CONTRACTS
E. CONTRACT/PR NO.: F41624-95-D-8002/0003/00
F. CONTRACTOR: The Environmental Co.

1. DATA ITEM NO.: A010
2. TITLE OF DATA ITEM: TECHNICAL REPORT - STUDY/SERVICES
3. SUBTITLE: PROJECT DEFINITION ITIR

4. AUTHORITY (DATA ACQUISITION DOC NO.): DI-MISC-80508
5. CONTRACT REFERENCE: SOW PARA 4.3.1.2.2
6. REQUIRING OFFICE: AFCEE/ERB

7. DD 250 REQ: LT
8. APP CODE: A
9. DIST STATEMENT REQUIRED: A
10. FREQ: ONE/R
11. AOD: BLK16
12. DATE OF FIRST SUB: BLOCK 16
13. DATE OF SUBSEQ SUB: BLOCK 16

14. DISTRIBUTION

a. ADDRESSEE	b. COPIES Draft	Final Reg	Final Repro
AFCEE/ERB	5	7	1
AFCEE/ERS	LT	LT	1
HSC/PKVCC	0	LT	0
DCMAO/ACO	0	LT	0
AFBCA/OL-H	1	1	0
SEE BLOCK 16			
15. TOTAL ---->	6	8	2

16. REMARKS

Block 10: Revise to incorporate Air Force comments and thereafter to incorporate Air Force changes.

Block 11: Effective date of Delivery Order.

Blocks 12 & 13: Submit within thirty (30) days after receipt of government tasking. Assume thirty (30) days for review.

Block 14: Reproducible shall be magnetic media delivered on a 3.5 inch diskette in IBM-compatible format.

G. PREPARED BY: AFCEE/ERS
H. DATE: 24-JAN-96
I. APPROVED BY: Charles C. Rice
CHARLES RICE, AFCEE/ERB
J. DATE: 24-JAN-96

17. PRICE GROUP: N/A
18. ESTIMATED TOTAL PRICE: NSP

DD Form 1423-1, JUN 90 (COMPUTER GENERATED) Previous editions are obsolete

CONTRACT DATA REQUIREMENTS LIST
(1 Data Item)

Form Approved
OMB NO. 0704-0188

A. CONTRACT LINE ITEM NO.: 0005
B. EXHIBIT: A
C. CATEGORY: TDP ____ TM ____ OTHER ENVR

D. SYSTEM/ITEM: PA/SI/RI/FS/RD CONTRACTS
E. CONTRACT/PR NO.: F41624-95-D-8002/0003/00
F. CONTRACTOR: The Environmental Co.

1. DATA ITEM NO.: A011
2. TITLE OF DATA ITEM: ENVIRONMENTAL SITE CHARACTERIZATION SUMMARY INFORMAL TECHNICAL INFORMATION REPORT (ITIR)
3. SUBTITLE: N/A

4. AUTHORITY (DATA ACQUISITION DOC NO.): OT-94-34102
5. CONTRACT REFERENCE: SOW PARA 4.3.1.2.3
6. REQUIRING OFFICE: AFCEE/ERB

7. DD 250 REQ: LT
8. APP CODE: A
9. DIST STATEMENT REQUIRED: A
10. FREQ: ASREQ
11. AOD: N/A
12. DATE OF FIRST SUB: BLOCK 16
13. DATE OF SUBSEQ SUB: BLOCK 16

14. DISTRIBUTION

a. ADDRESSEE	b. COPIES Draft	Final Reg	Final Repro
AFCEE/ERB	5	7	1
AFCEE/ERS	LT	LT	1
HSC/PKVCC	0	LT	0
DCMAO/ACO	0	LT	
AFBCA/OL-H	1	1	
SEE BLOCK 16			
15. TOTAL ---->	6	8	

16. REMARKS

Blocks 12 & 13: Submit in accordance with the approved project schedule. The Contractor shall incorporate any government comments and submit the final in accordance with the approved project schedule.

Block 14: Reproducible shall be magnetic media delivered on a 3.5 inch diskette in IBM-compatible format.

G. PREPARED BY: AFCEE/ERS
H. DATE: 24-JAN-96
I. APPROVED BY: CHARLES RICE, AFCEE/ERB
J. DATE: 24-JAN-96

17. PRICE GROUP: N/A
18. ESTIMATED TOTAL PRICE: NSP

Page 1 of 1 Pages

CONTRACT DATA REQUIREMENTS LIST
(1 Data Item)

Form Approved
OMB NO. 0704-0188

A. CONTRACT LINE ITEM NO.: 0005
B. EXHIBIT: A
C. CATEGORY: TDP ___ TM ___ OTHER MISC

D. SYSTEM/ITEM: PA/SI/RI/FS/RD CONTRACTS
E. CONTRACT/PR NO.: F41624-95-D-8002/0003/00
F. CONTRACTOR: The Environmental Co.

1. DATA ITEM NO.: A025
2. TITLE OF DATA ITEM: TECHNICAL REPORT - STUDY/SERVICES
3. SUBTITLE: CONCEPTUAL SITE MODEL ITIR

4. AUTHORITY (DATA ACQUISITION DOC NO.): DI-MISC-80508
5. CONTRACT REFERENCE: SOW PARA 4.6.1
6. REQUIRING OFFICE: AFCEE/ERB

7. DD 250 REQ: LT
8. APP CODE: A
9. DIST STATEMENT REQUIRED: A
10. FREQ: ASREQ
11. AOD: BLK16
12. DATE OF FIRST SUB: BLOCK 16
13. DATE OF SUBSEQ SUB: BLOCK 16

14. DISTRIBUTION

a. ADDRESSEE	b. COPIES Draft	Final Reg	Final Repro
AFCEE/ERB	5	7	1
AFCEE/ERS	LT	LT	1
HSC/PKVCC	0	LT	0
DCMAO/ACO	0	LT	0
AFBCA/OL-H	1	1	0
SEE BLOCK 16			
15. TOTAL ---->	6	8	2

16. REMARKS

Block 11: Effective date of Delivery Order.

Blocks 12 & 13: Submit within thirty (30) days after receipt of government tasking. Assume thirty (30) days for review.

Block 14: Reproducible shall be magnetic media delivered on 3.5 inch diskette, in IBM-compatible format.

The Handbook for the Installation Restoration Program (IRP), Remedial Investigations and Feasibility Studies (RI/FS) may be used as guidance for the report.

G. PREPARED BY: AFCEE/ERS
H. DATE: 24-JAN-96
I. APPROVED BY: CHARLES RICE, AFCEE/ERB
J. DATE: 24-JAN-96

17. PRICE GROUP: N/A
18. ESTIMATED TOTAL PRICE: NSP

Page 1 of 1 Pages

CONTRACT DATA REQUIREMENTS LIST
(1 Data Item)

Form Approved
OMB NO. 0704-0188

A. CONTRACT LINE ITEM NO.: 0005
B. EXHIBIT: A
C. CATEGORY: TDP ___ TM ___ OTHER MISC

D. SYSTEM/ITEM: PA/SI/RI/FS/RD CONTRACTS
E. CONTRACT/PR NO.: F41624-95-D-8002/0003/00
F. CONTRACTOR: The Environmental Co.

1. DATA ITEM NO.: A026
2. TITLE OF DATA ITEM: TECHNICAL REPORT - STUDY/SERVICES
3. SUBTITLE: ECOLOGICAL AND BASELINE RISK ASSESSMENT ITIR

4. AUTHORITY (DATA ACQUISITION DOC NO.): DI-MISC-80508
5. CONTRACT REFERENCE: SOW PARA 4.6.2
6. REQUIRING OFFICE: AFCEE/ERB

7. DD 250 REQ: LT
8. APP CODE: A
9. DIST STATEMENT REQUIRED: A
10. FREQ: ASREQ
11. AOD: BLK16
12. DATE OF FIRST SUB: BLOCK 16
13. DATE OF SUBSEQ SUB: BLOCK 16

14. DISTRIBUTION

a. ADDRESSEE	b. COPIES Draft	Final Reg	Final Repro
AFCEE/ERB	5	7	
AFCEE/ERS	LT	LT	
HSC/PKVCC	0	LT	
DCMAO/ACO	0	LT	
AFBCA/OL-H	1	1	
SEE BLOCK 16			
15. TOTAL ---->	6	8	

16. REMARKS

Block 11: Effective date of Delivery Order.

Blocks 12 & 13: Submit within thirty (30) days after receipt of government tasking. Assume thirty (30) days for review.

Block 14: Reproducible shall be magnetic media delivered on 3.5 inch diskette, in IBM-compatible format.

The Handbook for the Installation Restoration Program (IRP), Remedial Investigations and Feasibility Studies (RI/FS) may be used as guidance for the report.

G. PREPARED BY: FCEE/ERS
H. DATE: 24-JAN-96
I. APPROVED BY: CHARLES RICE, AFCEE/ERB
J. DATE: 24-JAN-96

17. PRICE GROUP: N/A
18. ESTIMATED TOTAL PRICE: NSP

Page 1 of 1 Pages

379 . 78

CONTRACT DATA REQUIREMENTS LIST
(1 Data Item)

Form Approved
OMB NO. 0704-0188

A. CONTRACT LINE ITEM NO.: 0005
B. EXHIBIT: A
C. CATEGORY: TDP ____ TM ____ OTHER MISC

D. SYSTEM/ITEM: PA/SI/RI/FS/RD CONTRACTS
E. CONTRACT/PR NO.: F41624-95-D-8002/0003/00
F. CONTRACTOR: The Environmental Co.

1. DATA ITEM NO.: A035
2. TITLE OF DATA ITEM: TECHNICAL REPORT - STUDY/SERVICES
3. SUBTITLE: PRELIMINARY LABORATORY REVIEW PACKAGES

4. AUTHORITY (DATA ACQUISITION DOC NO.): DI-MISC-80508
5. CONTRACT REFERENCE: SOW PARA 3.3.3
6. REQUIRING OFFICE: AFCEE/ERB

7. DD 250 REQ: LT
9. DIST STATEMENT REQUIRED: A
10. FREQ: ASREQ
12. DATE OF FIRST SUB: BLOCK 16
8. APP CODE: A
11. AOD: N/A
13. DATE OF SUBSEQ SUB: BLOCK 16

16. REMARKS

Block 10: Submit in accordance with the approved project schedule.

Blocks 12 & 13: Submit in accordance with approved project schedule.

Block 14: Reproducible copy shall be magnetic media delivered on a 3.5 inch diskette in IBM compatible format.

14. DISTRIBUTION

a. ADDRESSEE	b. COPIES Draft	Final Reg	Final Repro
AFCEE/ERB	5	7	0
AFCEE/ERS	LT	LT	1
HSC/PKVCC	LT	LT	0
DCMAO/ACO	LT	LT	0
AFBCA/OL-H	1	1	0
AFCEE/ERC	0	1	0
SEE BLOCK 16			
15. TOTAL ---->	6	9	1

G. PREPARED BY: AFCEE/ERS
H. DATE: 24-JAN-96
I. APPROVED BY: CHARLES RICE, AFCEE/ERB
J. DATE: 24-JAN-96

17. PRICE GROUP: N/A
18. ESTIMATED TOTAL PRICE: NSP

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CONTRACT DATA REQUIREMENTS LIST
(1 Data Item)

Form Approved
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A. CONTRACT LINE ITEM NO.: 0005
B. EXHIBIT: A
C. CATEGORY: TDP ____ TM ____ OTHER MISC

D. SYSTEM/ITEM: PA/SI/RI/FS/RD CONTRACTS
E. CONTRACT/PR NO.: F41624-95-D-8002/0003/00
F. CONTRACTOR: The Environmental Co.

1. DATA ITEM NO.: A031
2. TITLE OF DATA ITEM: COLOR PHOTOGRAPH PRINTS
3. SUBTITLE: N/A

4. AUTHORITY (DATA ACQUISITION DOC NO.): DI-MISC-80192
5. CONTRACT REFERENCE: SOW PARA 4.8.5
6. REQUIRING OFFICE: AFCEE/ERB

7. DD 250 REQ: LT
8. APP CODE: N/A
9. DIST STATEMENT REQUIRED: A
10. FREQ: ASREQ
11. AOD: N/A
12. DATE OF FIRST SUB: BLOCK 16
13. DATE OF SUBSEQ SUB: BLOCK 16

16. REMARKS

Block 10, 12 & 13: Submission dates will be the date for the related report.

Block 16: Submittals shall be with Technical Report.

Blocks 12 & 13: Submit within thirty (30) days after receipt of government tasking. Assume thirty (30) days for review.

Block 14: Reproducible shall be photographic negative.

14. DISTRIBUTION

a. ADDRESSEE	b. COPIES Draft	Final Reg	Final Repro
AFCEE/ERB	0	1	1
AFCEE/ERS	LT	LT	1
HSC/PKVCC	0	LT	0
DCMAO/ACO	0	LT	0
AFBCA/OL-H	1	1	
SEE BLOCK 16			
15. TOTAL ---->	1	2	

G. PREPARED BY: AFCEE/ERS
H. DATE: 24-JAN-96
I. APPROVED BY: CHARLES RICE, AFCEE/ERB
J. DATE: 24-JAN-96

17. PRICE GROUP: N/A
18. ESTIMATED TOTAL PRICE: NSP

Page 1 of 1 Pages

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CONTRACT DATA REQUIREMENTS LIST (1 Data Item)

Form Approved
OMB NO. 0704-0188

A. CONTRACT LINE ITEM NO.	B. EXHIBIT	C. CATEGORY:
0005	B	TDP ____ TM ____ OTHER ENVR

D. SYSTEM/ITEM	E. CONTRACT/PR NO.	F. CONTRACTOR
PA/SI/RI/FS/RD CONTRACTS	F41624-95-D-8002/0003/00	The Environmental Co.

1. DATA ITEM NO.	2. TITLE OF DATA ITEM	3. SUBTITLE
B003	INSTALLATION RESTORATION PROGRAM INFORMATION MANAGEMENT SYSTEM (IRPIMS)	N/A

4. AUTHORITY (DATA ACQUISITION DOC NO.)	5. CONTRACT REFERENCE	6. REQUIRING OFFICE
OT-94-34101	SOW PARA 4.8.3	AFCEE/ERB

7. DD 250 REQ	9. DIST STATEMENT REQUIRED	10. FREQ	12. DATE OF FIRST SUB
LT		ASREQ	BLOCK 16
8. APP CODE		11. AOD	13. DATE OF SUBSEQ SUB
N/A	B	BLK16	BLOCK 16

14. DISTRIBUTION

a. ADDRESSEE	b. COPIES Draft	Final Reg	Final Repro
AFCEE/ERB	0	LT	0
AFCEE/ERS	0	LT	0
HSC/PKVCC	0	LT	0
DCMAO/ACO	0	LT	0
AFCEE/MSC	0	1	1
SEE BLOCK 16			
15. TOTAL ---->	0	1	1

16. REMARKS

Block 10: Submission dates will be specified in each Delivery Order.

Block 11: Effective date of Delivery Order.

.ocks 12 & 13: Submit within thirty (30) days after receipt of government tasking.

Block 14: Magnetic media delivered on a 3.5 inch diskette in IBM-compatible format.

The IRPIMS Data Loading Handbook, the IRPIMS Contractor Data Loading Tool Handbook, and IRPIMS Quality Control Tool Handbook,may be used as guidance for format and content in the preparation of the IRPMS data files.

G. PREPARED BY	H. DATE	I. APPROVED BY	J. DATE
.FCEE/ERS	24-JAN-96	CHARLES RICE, AFCEE/ERB	24-JAN-96

17. PRICE GROUP	18. ESTIMATED TOTAL PRICE
N/A	NSP

Page 1 of 1 Pages

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CONTRACT DATA REQUIREMENTS LIST
(1 Data Item)

Form Approved
OMB NO. 0704-0188

A. CONTRACT LINE ITEM NO.: 0005
B. EXHIBIT: B
C. CATEGORY: TDP ___ TM ___ OTHER ADMN
D. SYSTEM/ITEM: PA/SI/RI/FS/RD CONTRACTS
E. CONTRACT/PR NO.: F41624-95-D-8002/0003/00
F. CONTRACTOR: The Environmental Co.
1. DATA ITEM NO.: B004
2. TITLE OF DATA ITEM: PRESENTATION MATERIALS
3. SUBTITLE: N/A
4. AUTHORITY (DATA ACQUISITION DOC NO.): DI-ADMN-81373
5. CONTRACT REFERENCE: SOW PARA 4.8.4
6. REQUIRING OFFICE: AFCEE/ERB
7. DD 250 REQ: LT
8. APP CODE: A
9. DIST STATEMENT REQUIRED: A
10. FREQ: ASREQ
11. AOD: N/A
12. DATE OF FIRST SUB: BLOCK 16
13. DATE OF SUBSEQ SUB: BLOCK 16

14. DISTRIBUTION

a. ADDRESSEE	b. COPIES Draft	Final Reg	Final Repro
AFCEE/ERB	1	1	C
AFCEE/ERS	0	LT	1
HSC/PKVCC	0	LT	0
DCMAO/ACO	0	LT	0
AFBCA/OL-H	1	1	
SEE BLOCK 16			
15. TOTAL ---->	2	2	

16. REMARKS -

Blocks 12 and 13: Submit in accordance with approved project schedule.

Block 14: Reproducible shall be magnetic media delivered on 3.5 inch diskette, in IBM-compatible format.

G. PREPARED BY: AFCEE/ERS
H. DATE: 24-JAN-96
I. APPROVED BY: Charles Rice
CHARLES RICE, AFCEE/ERB
J. DATE: 24-JAN-96
17. PRICE GROUP: N/A
18. ESTIMATED TOTAL PRICE: NSP

Page 1 of 1 Pages

CONTRACT DATA REQUIREMENTS LIST
(1 Data Item)

Form Approved
OMB NO. 0704-0188

A. CONTRACT LINE ITEM NO.: 0005
B. EXHIBIT: B
C. CATEGORY: TDP ____ TM ____ OTHER MISC

D. SYSTEM/ITEM: PA/SI/RI/FS/RD CONTRACTS
E. CONTRACT/PR NO.: F41624-95-D-8002/0003/00
F. CONTRACTOR: The Environmental Co.

1. DATA ITEM NO.: B001
2. TITLE OF DATA ITEM: MASTER INTEGRATED PROGRAM SCHEDULE (MIPS)
3. SUBTITLE: N/A

4. AUTHORITY (DATA ACQUISITION DOC NO.): DI-MISC-81183
5. CONTRACT REFERENCE: SOW PARA 4.8.2
6. REQUIRING OFFICE: AFCEE/ERB

7. DD 250 REQ: LT
8. APP CODE: N/A
9. DIST STATEMENT REQUIRED: A
10. FREQ: ASREQ
11. AOD: N/A
12. DATE OF FIRST SUB: BLOCK 16
13. DATE OF SUBSEQ SUB: BLOCK 16

14. DISTRIBUTION

a. ADDRESSEE	b. COPIES Draft	Final Reg	Final Repro
AFCEE/ERB	0	1	0
AFCEE/ERS	0	LT	1
HSC/PKVCC	0	LT	0
DCMAO/ACO	0	LT	0
AFCEE/ERSC	0	1	0
AFBCA/OL-H	0	1	0
SEE BLOCK 16			
15. TOTAL ---->	0	3	1

16. REMARKS

Block 4: Para 7.2 - This contract is construed to be Production.

Para 7.3 - The type of media to be used will vary, and will correlate to the following DID paragraphs:
Para 10.2.2, 10.2.3, & 10.2.4 - Summary, Intermediate, or Detailed Schedule graphical displays shall be submitted in hardcopy form.

Para 10.2.5 - Periodic Analysis Schedule Reports shall be submitted in both hardcopy and computer based electronic media. Electronic media data will be submitted on a 3.5 " IBM DOS formatted diskette in "ASCII" delimited file format.

Para 10.2.6 - Integrated Program Network Schedule shall be submitted in hardcopy form. Abbreviations may be used as appropriate.

Para 10.2.1 - Delete "or weapon system contractor".

Block 11: 30 calendar days after the effective date of the Delivery Order or the end of the contractors first cost accounting period.

Blocks 12 & 13: Not later than 20 calendar days following the initial and all subsequent cost reporting periods.

Block 14: Reproducible shall be magetic media delivered on a 3.5 inch diskette in IBM-compatible format.

G. PREPARED BY: AFCEE/ERS
H. DATE: 24-JAN-96
I. APPROVED BY: Charles C. Rice
CHARLES RICE, AFCEE/ERB
J. DATE: 24-JAN-96

17. PRICE GROUP: N/A
18. ESTIMATED TOTAL PRICE: NSP

Page 1 of 1 Pages

379 83

CONTRACT DATA REQUIREMENTS LIST (1 Data Item)	Form Approved OMB NO. 0704-0188

Public reporting burden for this collection of information is estimated to average 110 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden, estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Services, Directorate for Information and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project(0704-0188), Washington, DC 20503. Please DO NOT RETURN your form to either of these addresses. Send completed form to the Government Issuing Contracting Officer for the Contract/PR NO listed in Block E.

A. CONTRACT LINE ITEM NO. 0005	B. EXHIBIT B	C. CATEGORY: TDP ___ TM ___ OTHER ADMN
D. SYSTEM/ITEM PA/SI/RI/FS/RD CONTRACTS	E. CONTRACT/PR NO. F41624-95-D-8002/0003/00	F. CONTRACTOR The Environmental Co.
1. DATA ITEM NO. B005	2. TITLE OF DATA ITEM CONFERENCE MINUTES	3. SUBTITLE N/A
4. AUTHORITY (DATA ACQUISITION DOC NO.) DI-ADMN-81250A	5. CONTRACT REFERENCE SOW PARA 4.8.6	6. REQUIRING OFFICE AFCEE/ERB

7. DD 250 REQ LT	9. DIST STATEMENT REQUIRED A	10. FREQ ASREQ	12. DATE OF FIRST SUB BLOCK 16
8. APP CODE A		11. AOD N/A	13. DATE OF SUBSEQ SUB BLOCK 16

14. DISTRIBUTION

a. ADDRESSEE	b. COPIES Draft	Final Reg	Final Repro
AFCEE/ERB	1	1	0
AFCEE/ERS	LT	LT	1
HSC/PKVCC	0	1	0
DCMAO/ACO	0	LT	0
AFBCA/OL-H	1	1	
SEE BLOCK 16			
15. TOTAL ---->	2	3	

16. REMARKS

Block 12: Submit within fifteen (15) Calendar days of conference.

Block 13: The contractor shall incorporate any Government comments and submit the final minutes within 5 calendar days.

Block 14: Reproducible shall be magnetic media delivered on 3.5 inch diskette, in IBM-compatible format.

G. PREPARED BY AFCEE/ERS	H. DATE 24-JAN-96	I. APPROVED BY CHARLES RICE, AFCEE/ERB	J. DATE 24-JAN-96
17. PRICE GROUP N/A	18. ESTIMATED TOTAL PRICE NSP		

Page 1 of 1 Pages

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CONTRACT DATA REQUIREMENTS LIST
(1 Data Item)

Form Approved
OMB NO. 0704-0188

A. CONTRACT LINE ITEM NO.	B. EXHIBIT	C. CATEGORY:
0005	B	TDP ___ TM ___ OTHER FNCL

D. SYSTEM/ITEM	E. CONTRACT/PR NO.	F. CONTRACTOR
PA/SI/RI/FS/RD CONTRACTS	F41624-95-D-8002/0003/00	The Environmental Co.

1. DATA ITEM NO.	2. TITLE OF DATA ITEM	3. SUBTITLE
B006	PERFORMANCE AND COST REPORT	N/A

4. AUTHORITY (DATA ACQUISITION DOC NO.)	5. CONTRACT REFERENCE	6. REQUIRING OFFICE
DI-FNCL-80912	SOW PARA 4.8.1	AFCEE/ERB

7. DD 250 REQ	9. DIST STATEMENT REQUIRED	10. FREQ	12. DATE OF FIRST SUB
LT		MTHLY	BLOCK 16
8. APP CODE		11. AOD	13. DATE OF SUBSEQ SUB
N/A	B	BLOCK 16	BLOCK 16

14. DISTRIBUTION

a. ADDRESSEE	b. COPIES Draft	Final Reg	Final Repro
AFCEE/ERB	0	1	0
AFCEE/ERS	0	LT	1
AFCEE/ERSC	0	1	0
HSC/PKVCC	0	1	0
DCMAO/ACO	0	LT	0
SEE BLOCK 16			
15. TOTAL ---->	0	3	1

16. REMARKS

Block 11: The end of the contractor's first and all subsequent cost accounting periods.

Blocks 12 & 13: Submit the initial report thirty (30) calendar days after the effective date of the Delivery Order or the end of the contractor's first cost accounting period whichever occurs first. Subsequent reports shall be monthly thereafter.

Block 14: Reproducible copy shall be magnetic media delivered on a 3.5 inch diskette in IBM-compatible format.

G. PREPARED BY	H. DATE	I. APPROVED BY	J. DATE
AFCEE/ERS	24-JAN-96	Charles Rice CHARLES RICE, AFCEE/ERB	24-JAN-96

17. PRICE GROUP	18. ESTIMATED TOTAL PRICE	
N/A	NSP	Page 1 of 1 Pages

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CONTRACT DATA REQUIREMENTS LIST
(1 Data Item)

Form Approved
OMB NO. 0704-0188

A. CONTRACT LINE ITEM NO. 0005
B. EXHIBIT B
C. CATEGORY: TDP ____ TM ____ OTHER FNCL

D. SYSTEM/ITEM PA/SI/RI/FS/RD CONTRACTS
E. CONTRACT/PR NO. F41624-95-D-8002/0003/00
F. CONTRACTOR The Environmental Co.

1. DATA ITEM NO. B007
2. TITLE OF DATA ITEM MAN HOURS EXPENDITURE CHART
3. SUBTITLE N/A

4. AUTHORITY (DATA ACQUISITION DOC NO.) DI-FNCL-80003
5. CONTRACT REFERENCE SOW PARA 4.8.1
6. REQUIRING OFFICE AFCEE/ERB

7. DD 250 REQ LT
8. APP CODE N/A
9. DIST STATEMENT REQUIRED B
10. FREQ MTHLY
11. AOD BLOCK 16
12. DATE OF FIRST SUB BLOCK 16
13. DATE OF SUBSEQ SUB BLOCK 16

14. DISTRIBUTION

a. ADDRESSEE	b. COPIES Draft	Final Reg	Final Repro
AFCEE/ERB	0	1	0
AFCEE/ERS	0	LT	1
HSC/PKVCC	0	LT	0
DCMAO/ACO	0	LT	0
AFCEE/ERSC	0	1	0
SEE BLOCK 16			
15. TOTAL ---->	0	2	1

16. REMARKS

Blocks 11, 12 & 13: Submit with CDRL B006.

Block 14: Reproducible copy shall be magnetic media delivered on a 3.5 inch diskette in IBM compatible format.

G. PREPARED BY AFCEE/ERS
H. DATE 24-JAN-96
I. APPROVED BY Charles A. Rice CHARLES RICE, AFCEE/ERB
J. DATE 24-JAN-96

17. PRICE GROUP N/A
18. ESTIMATED TOTAL PRICE NSP

Page 1 of 1 Pages

ASSUMPTIONS FOR A COST ESTIMATE FOR THE SITE ASSESSMENT, INVESTIGATION, AND CHARACTERIZATION OF THE RECREATIONAL VEHICLE (RV) FAMILY CAMPING (FAM CAMP) AREA AT NAVAL AIR STATION (NAS) FORT WORTH, TEXAS

There are three 30-foot groundwater monitoring wells proposed for this effort. Three existing wells will also be used to obtain samples.

The sampling and analysis effort will consist of:

Groundwater media:	11 volatile organic analyses (VOCs) 9 base-neutral extractions 9 target analyte list (TAL) metals
Subsurface media:	46 VOCs 43 base-neutral extractions 43 TAL metals

The site characterization effort will use the analytical results to determine the presence, source, nature, and extent of contamination. This effort will include a conceptual site model and a baseline risk assessment.

Base Support

The Air Force Base Conversion Agency (AFBCA) will provide the following support for Contract F41624-95-D-8002, Delivery Order 0003:

a. Provide contractor(s) with existing engineering plans, drawings, diagrams, aerial photographs, etc., to facilitate evaluation of the IRP site under investigation.

b. Arrange for personnel identification badges, vehicle passes, and/or entry permits.

c. Provide areas for staging, decontamination, and temporary waste storage. Contractor(s) will make every effort to remove waste from the base in an expedient, yet cost-effective manner.

d. Supply sources of electrical power and water. Contractor(s) will be responsible for any utility connections required.

e. Provide empty office space for contractor(s) use during the field activities.

General Decision Number TX950046

Superseded General Decision No. TX940046

State: TEXAS

Construction Type:
HEAVY

County(ies):
JOHNSON PARKER TARRANT

Heavy Construction Projects (Including Water and Sewer Lines)

Modification Number	Publication Date
0	02/10/1995

COUNTY(ies):
JOHNSON PARKER TARRANT

PLUM0146B 05/01/1993

	Rates	Fringes
PLUMBERS/PIPEFITTERS	16.98	2.74

SUTX2047A 06/01/1990

	Rates	Fringes
CARPENTERS	10.40	$3.64
CONCRETE FINISHERS	9.81	
ELECTRICIANS	13.26	
FORM SETTERS	7.86	
LABORERS:		
Common	6.37	
Utility	8.09	
PAINTERS	10.89	
PIPELAYERS	8.43	
POWER EQUIPMNENT OPERATORS:		
Backhoe	11.89	3.30
Bulldozer	10.76	
Crane	13.16	3.30
Front End Loader	10.54	
Mechanic	10.93	
Scraper	10.00	
REINFORCING STEEL SETTERS	10.64	
TRUCK DRIVERS	7.34	

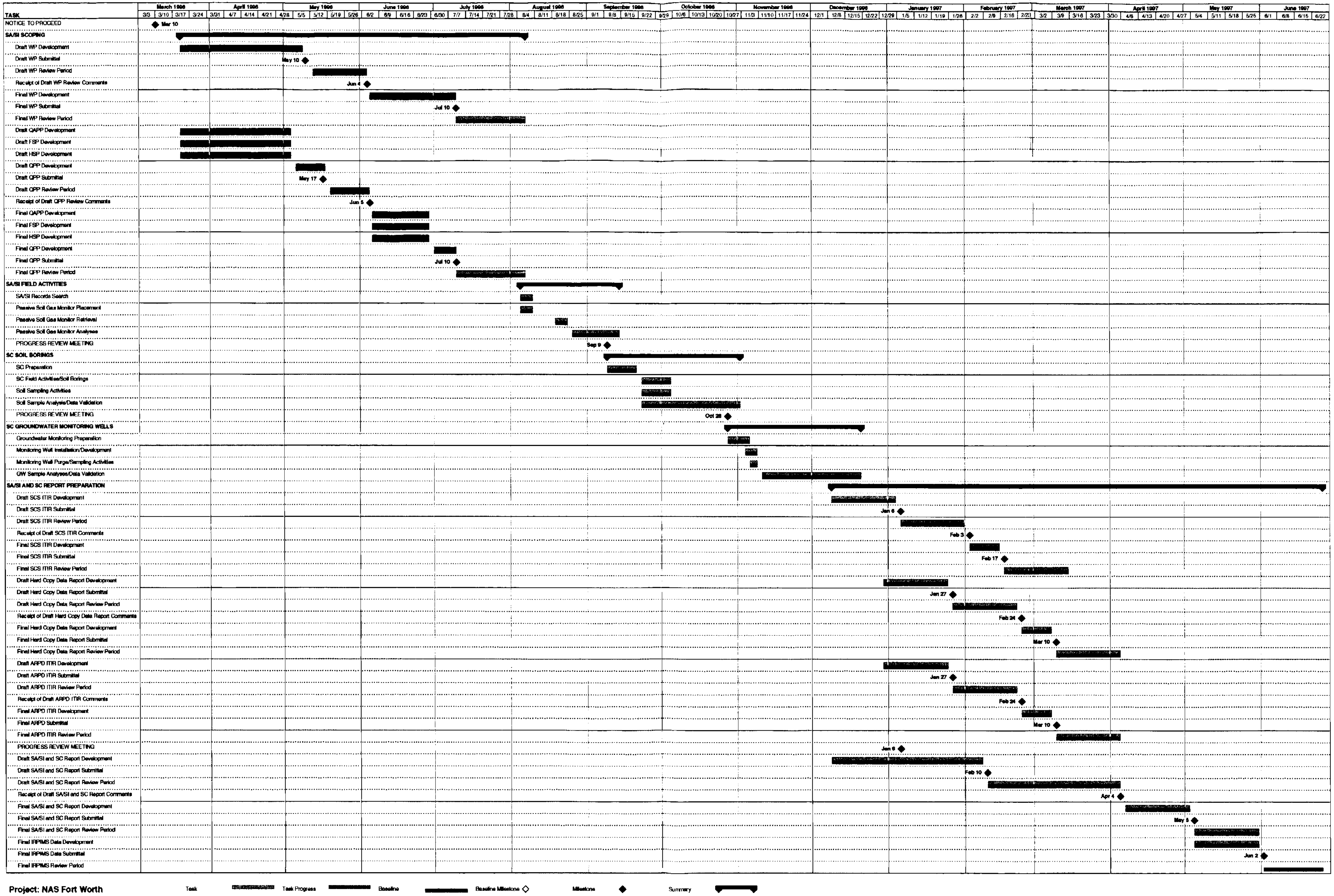
WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

Requests for additional classifications and wage rates may be submitted to the contracting officer after award, and may be approved only if: (1) the work to be performed by the classification requested is not performed by a classification in the wage determination; (2) the classification is utilized in the area by the construction industry; and (3) the proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination (for the given area and type of construction). (See 29 CFR 5.5(a) (v)).

In the listing above, the "SU" designation means that rates listed under that identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

APPENDIX B

PROJECT SCHEDULE



Project: NAS Fort Worth
Date: Tue 7/9/96

TAB

Health and Safety Plan

379. 93

HEALTH AND SAFETY PLAN

SITE ASSESSMENT, INVESTIGATION, AND CHARACTERIZATION OF THE RECREATIONAL VEHICLE (RV) FAMILY CAMPING (FAM CAMP) AREA

NAVAL AIR STATION (NAS) FORT WORTH JOINT RESERVE BASE (JRB) CARSWELL FIELD, TEXAS

Contract No. F41624-95-D-8002
Delivery Order 0003

July 1996

Prepared for:

Air Force Material Command (AFMC)
Headquarters (HQ) Human Systems Center (HSC) PKVCC
3207 North Road
Brooks AFB, Texas 78235-5363

Prepared by:

The Environmental Company, Inc.
1230 Cedars Court, Suite 100
Post Office Box 5127
Charlottesville, Virginia 22905

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<u>AFBCA</u>		
Olen Long, AFBCA/OL-H NAS Fort Worth	2	8 - 9
<u>TEC</u>		
Jack E. Wilson Project Director	1	10
Glenn M. Metzler Project Manager	1	11
Allistair Downie Corporate Health and Safety Manager	1	12

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TEC Project File	3

COPY NO. 9

PREFACE

This Health and Safety Plan (HSP) was prepared by The Environmental Company, Inc. (TEC) for the site assessment, investigation, and characterization of the area in the vicinity of the Recreational Vehicle (RV) Family Camping (Fam Cam) Area at Naval Air Station (NAS) Forth Worth, Texas (Project No. 95-8021). This HSP is a project scoping document prepared under Contract No. F41624-95-D-8002, Delivery Order 0003. for Project No. 95-8021.

This HSP has been written as a guidance documents for use by properly trained and experienced personnel to conduct field work according to the HSP. This HSP is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if these operations or conditions change.

This HSP was written under the direction of Mr. Glenn M. Metzler, TEC Project Manager. The Contracting Officer's Representative for this project is Mr. Charles Rice, Air Force Center for Environmental Excellence (AFCEE), Environmental Restoration Branch (ERB), Brooks Air Force Base (AFB), Texas.

Approved By: Date:

Glenn M. Metzler July 9, 96
Project Manager
The Environmental Company, Inc.

Approved By: Date:

Jack E. Wilson July 9, 1996
Jack E. Wilson, P.E.
Project Director
The Environmental Company, Inc.

Approved By: Date:

7/9/96
Allistair Downie
Corporate Health and Safety Manager
The Environmental Company, Inc.

NOTICE

This report has been prepared for the United States Air Force by The Environmental Company, Inc. (TEC) for the purpose of aiding in the implementation of a final remedial action plan under the Air Force Installation Restoration Program (IRP).

Although the area of study is being investigated in accordance with IRP guidance, the area has not been identified as an IRP site. NAS Fort Worth (formerly Carswell Air Force Base) is undergoing property disposal/reuse pursuant to the Defense Base Closure and Realignment Act of 1990 and Round II of the Base Closure Commission deliberations. The area of study is being considered for property disposal or reuse and the Air Force Base Conversion Agency (AFBCA) desires to investigate the area to confirm or deny the presence of contamination.

As the report relates to actual or possible releases of potentially hazardous substances, its release prior to a United States Air Force final decision on remedial action may be in the public's interest. The limited objectives of this report and the ongoing nature of the IRP, along with the evolving knowledge of site conditions and chemical effects on the environment and health, must be considered when evaluating this report since subsequent facts may become known that may make this report premature or inaccurate.

Acceptance of this report in performance of the contract under which it is prepared does not mean that the Air Force adopts the conclusions, recommendations, or other views expressed herein, which are those of the contractor only and do not necessarily reflect the official position of the United States Air Force.

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REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*

2. REPORT DATE
July 1996

3. REPORT TYPE AND DATES COVERED
Final-July 1996

4. TITLE AND SUBTITLE
HEALTH AND SAFETY PLAN
SITE ASSESSMENT, INVESTIGATION, AND CHARACTERIZATION OF THE RECREATIONAL VEHICLE (RV) FAMILY CAMPING (FAM CAMP) AREA
NAVAL AIR STATION (NAS) FORT WORTH
JOINT RESERVE BASE (JRB)
CARSWELL FIELD, TEXAS

5. FUNDING NUMBERS
F41624-95-D-8002
Delivery Order 0003

6. AUTHOR(S)
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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
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NA

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Base Closure Division
Brooks AFB, TX 78235

10. SPONSORING/MONITORING AGENCY REPORT NUMBER
NA

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

This Health and Safety Plan has been prepared by TEC for the site assessment, investigation, and characterization of an area in the vicinity of the Recreational Vehicle Family Camping Area at Naval Air Station Fort Worth, Texas. It has been written for use by properly trained and experienced employees of The Environmental Company and any other individuals authorized to access areas at the site where site control is established to conduct field work. The health and safety guidelines in this plan were prepared specifically for this site and should not be used on any other site without prior research by trained health and safety professionals. The overall intent of this HSP is to create a site health and safety program that effectively identifies, controls, and reduces health and safety hazards.

14. SUBJECT TERMS
HEALTH AND SAFETY PLAN

15. NUMBER OF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	

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LIST OF ACRONYMS

AFBCA	Air Force Base Conversion Agency
AFCEE	Air Force Center for Environmental Excellence
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFR	Code of Federal Regulations
CHSM	Corporate Health and Safety Manager
COE	Corps of Engineers
COR	Contracting Officer's Representative
CPR	Cardiopulmonary Resuscitation
DOD	Department of Defense
DOT	Department of Transportation
EPA	Environmental Protection Agency
FS	Feasibility Study
FSA	Fuel Storage Area
GFCI	Ground Fault Circuit Interrupter
HMIS	Hazardous Material Information System
HSP	Health and Safety Plan
IDW	Investigative-Derived Waste
IRP	Installation Restoration Program
LEL	Lower Explosive Limit
MSDS	Material Safety Data Sheet
NAS	Naval Air Station
NEC	National Electric Codes
NFPA	National Fire Protection Agency
NIOSH	National Institute for Occupational Safety and Health
OJT	On-The-Job Training
OSHA	Occupational Safety and Health Administration

OSM	Office Safety Manager
PHSM	Project Health and Safety Manager
PPE	Personal Protective Equipment
ppm	Parts Per Million
QA	Quality Assurance
QC	Quality Control
QPP	Quality Program Plans
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RV	Recreational Vehicle
SARA	Superfund Amendments Reauthorization Act
SHSM	Site Health and Safety Manager
SOP	Standard Operating Procedures
SOW	Statement Of Work
STEL	Short-Term Exposure Limit
SWMU	Solid Waste Management Unit
TEC	The Environmental Company, Inc.
TLV	Threshold Limit Value
TWA	Time-Weighted Average
UEL	Upper Explosive Limit
VP	Vapor Pressure

DIRECTIONS TO NEAREST HOSPITAL

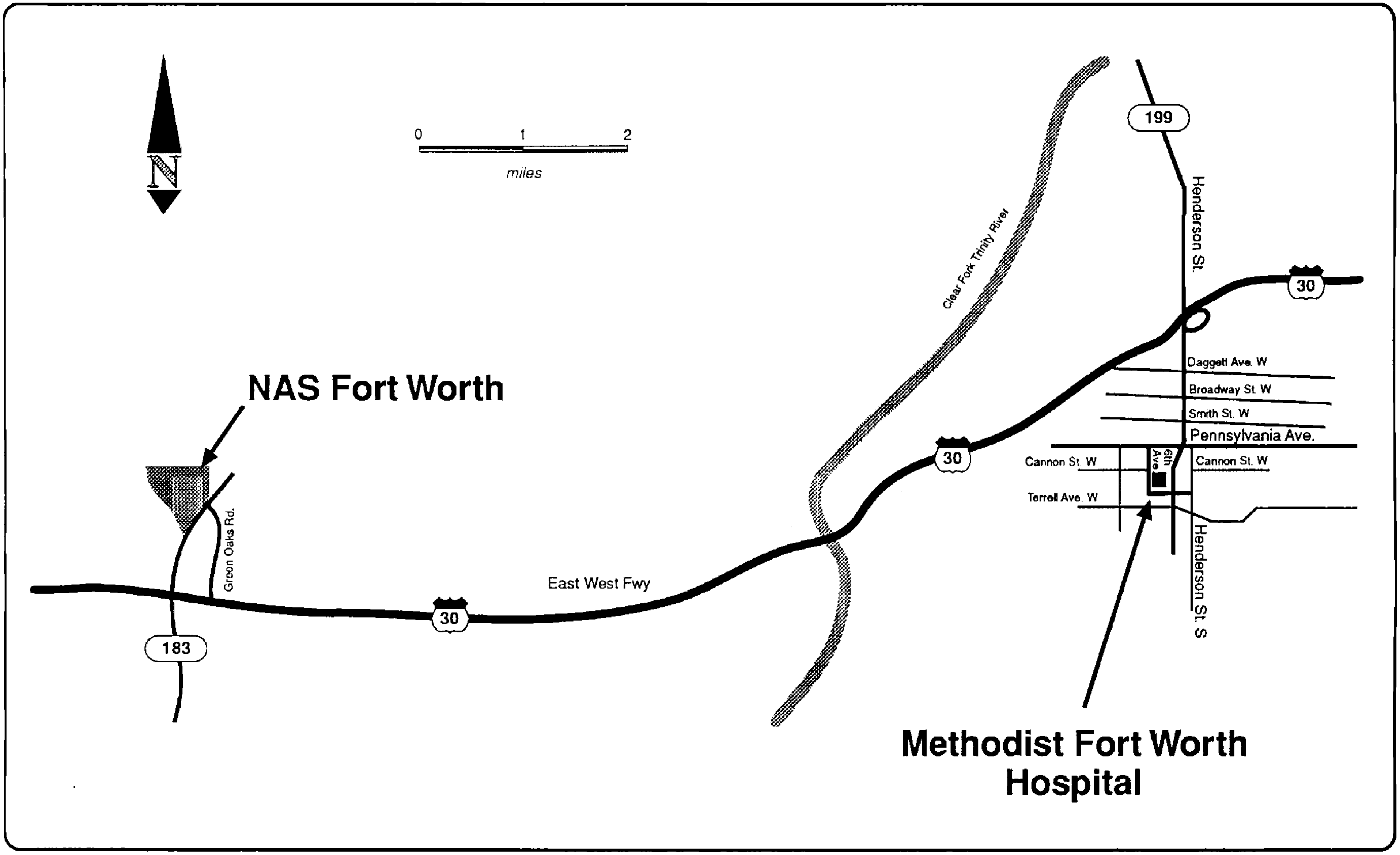
The station hospital is closed for use by site personnel.

The Harris Methodist Fort Worth Hospital is the initial primary care facility in case of an accident. The hospital is located at 1300 Pennsylvania Avenue, Fort Worth, Texas 76104.

Hospital:	(817) 882-2000
Emergency Room:	(817) 882-2000
Route to Hospital:	Refer to figure on the next page
Distance:	Approximately 12 miles
Directions:	From NAS Fort Worth, take Highway 183 south to I-30 east. Exit at Henderson Street. Proceed south on Henderson Street to Pennsylvania Avenue. The hospital is on the corner of 6th Street and Pennsylvania Avenue.

EMERGENCY INFORMATION

Admin Local Fire Department	(817) 738-1708
Fire/Ambulance/Police	(817) 738-3694 or 911
North Texas Poison Control Center	(800) 441-0040
USEPA Environmental Response Team	(201) 321-6660
CHEMTREC	(800) 424-9300
Dow Chemical Emergency Response	(517) 636-4400
DuPont Chemical Emergency Response	(302) 774-1000



Emergency Route to Hospital from NAS Fort Worth

1.0 INTRODUCTION

This Health and Safety Plan (HSP) has been written for use by employees of The Environmental Company, Inc. (TEC) and any other individuals authorized to access areas at the site where site control is established to conduct fieldwork. It may also be used as a guidance document by properly trained and experienced personnel; however, TEC does not guarantee the health and safety of any person entering this site. Because of the nature of this site and the activity occurring there, it is not possible to discover, evaluate, and provide protection for all possible hazards that may be encountered; however, known and suspected hazards are listed in Table 3-1. Strict adherence to the health and safety guidelines stated in this HSP will reduce, but not eliminate, the potential for injury on the site. The health and safety guidelines in this plan were prepared specifically for this site and should not be used on any other site without prior research by trained health and safety professionals.

This HSP has been prepared by TEC for the site assessment, investigation, and characterization of an area in the vicinity of the Recreational Vehicle (RV) Family Camping (Fam Camp) Area at Naval Air Station (NAS) Fort Worth, Texas (Project No. 95-8021), see Figure 1-1. This HSP was prepared under Contract No. F41624-95-D-8002, Delivery Order 0003.

This HSP will be kept on site during field activities and will be reviewed and updated as necessary to reflect current site conditions and operations. This HSP requires that the TEC Corporate Health and Safety Manager (CHSM), Project Health and Safety Managers (PHSM), and Project Manager (PM) be familiar with the following:

- applicable Federal, State, and local regulations;
- standard operating procedures (SOPs) contained in TEC's Health and Safety Policy Manual for Hazardous Waste Projects (TEC, 1992);
- requirements found in the Air Force Center for Environmental Excellence (AFCEE) Handbook for the Installation Restoration Program (IRP) Remedial Investigations and Feasibility Studies (RI/FS) (U.S. Air Force 1993);
- requirements found in the U.S. Army Corps of Engineers (COE) Safety and Health Requirements Manual (COE, 1992); and
- procedures contained in the Work Plan for this project and other Quality Program Plan (QPP) documents for the project.

In addition to this HSP, each subcontractor is expected to have their own health and safety program covering their specific operational activities (e.g., soil boring, well installation/development). In instances where overlaps or conflicts occur between requirements in this HSP and a subcontractor's health and safety procedures, the requirement that is most protective of the employee's health and safety will take precedence and be determined during premobilization and daily tailgate safety meetings. Additional information regarding adherence of this HSP by subcontractors is provided in Section 2.5.

The overall intent of this HSP is to create a site health and safety program that effectively identifies, evaluates, controls, and reduces health and safety hazards.

This HSP is written for the site conditions, purposes, dates, and personnel specified and must be amended if these conditions change. TEC claims no responsibility for use of this plan by others.

1.1 Project Background

NAS Fort Worth is supplied with JP4 through a privately owned distribution line originating in Aledo, Texas. The distribution line runs parallel with Highway 183 to the intersection of Roaring Springs then crosses the base golf course in the vicinity of the RV Fam Camp Area until reaching Rogner Drive. The line then turns north to parallel Rogner Drive and crosses Farmers Branch Creek in the vicinity of Ascol Drive continuing north until entering the main base and terminating at the Bulk Fuel Storage Area (FSA). Figure 1-1 illustrates the area to be investigated.

Reportedly, sometime in calendar year 1990, the City of Fort Worth performed boring operations in the Farmers Branch Creek near the main entrance to the base and strong odors of fuel were reported. This was told to the pipeline owner who supposedly conducted pressure tests and determined that the distribution line was not leaking. There are no records of the borings or the pressure tests to confirm these findings.

The purpose of this work is to investigate this area to confirm or deny the presence of contamination and to determine its nature and extent. The Air Force Base Conversion Agency (AFBCA) has labeled this site on the DD Form 1391 as the "RV parking area (Fam Camp)."

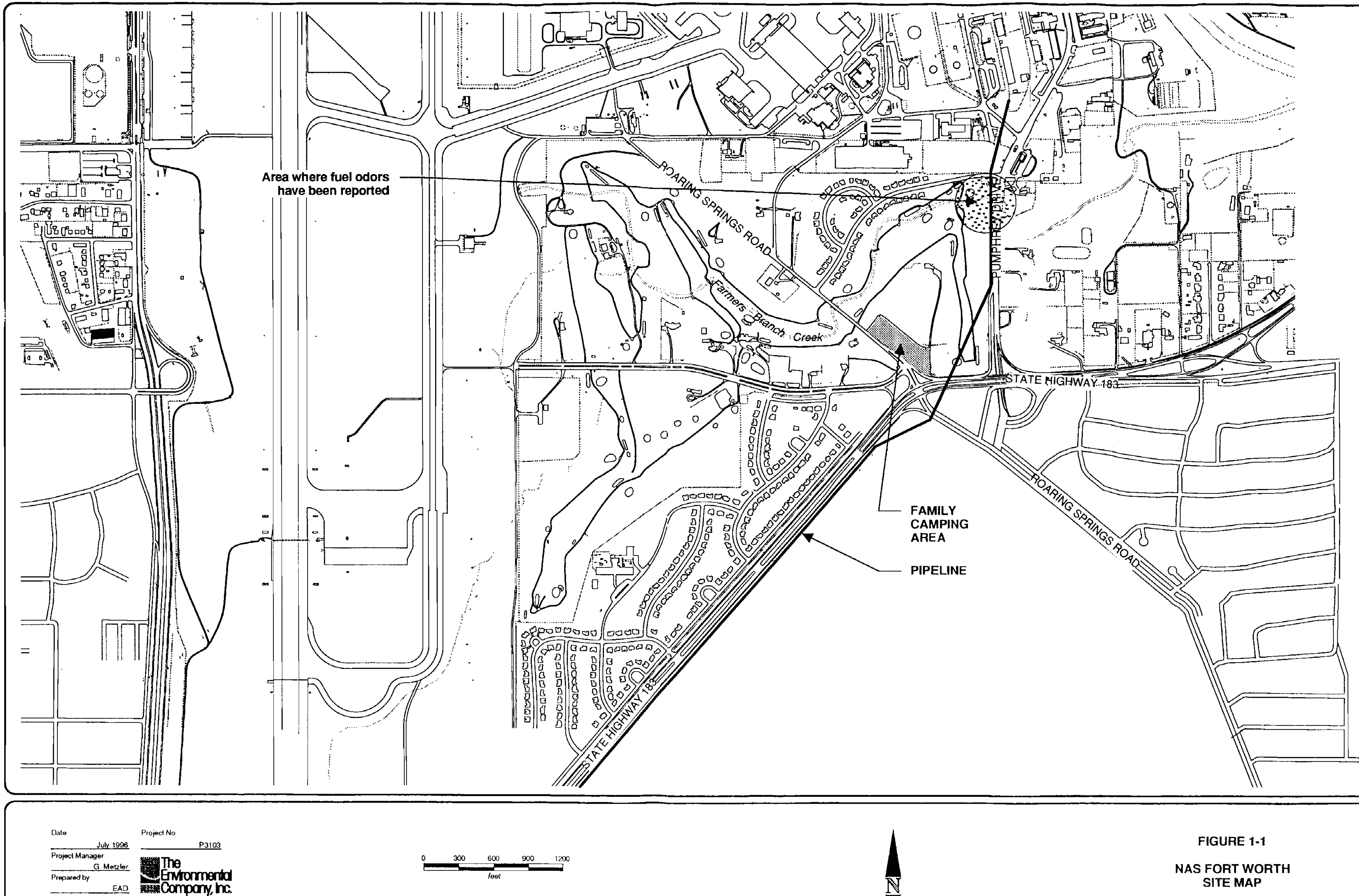
1.2 Project Objectives and Field Activities

The objectives of this effort are to perform a site assessment, investigation, and characterization of the area in the vicinity of the RV Fam Camp Area at NAS Fort Worth to determine the presence or absence of contamination, and to define the nature and extent of contamination (if determined to be present). The area of study will be parallel to the JP4 distribution line, beginning at Highway 183 and extending north to the Bulk FSA (a distance of approximately 3,000 linear feet).

TEC will implement the specific investigative and support activities as outlined in the Statement of Work (SOW) for Project No. 95-8021 and described in the Work Plan. This work will be conducted in accordance with the guidelines provided by AFCEE (U.S. Air Force 1993) and with approved procedures detailed in the Field Sampling Plan (FSP).

To accomplish project objectives, the following field activities will be performed by TEC personnel and project subcontractors:

- completion of a geophysical survey;
- location and identification of the abandoned reach field;
- location of all underground utilities will be located prior to initiating intensive activities;
- a Texas registered land surveyor will conduct a site survey to update site base map;



Date July 1996
Project Manager G. Metzler
Prepared by EAD
Project No P3103

The Environmental Company, Inc.

FIGURE 1-1

NAS FORT WORTH
SITE MAP

- performance of a soil gas survey along the JP4 distribution line to identify source areas and areas of potential soil/groundwater contamination;
- collection of representative groundwater samples from existing site groundwater monitoring wells to assess background water quality;
- advancement of 20 soil borings in potential source areas identified by the soil gas survey to define subsurface soil conditions, estimation of depth to groundwater, and evaluation of the vertical extent of contaminated soils, if encountered;
- collection of representative soil samples from the borings to evaluate soil quality;
- completion of six soil borings as groundwater monitoring wells to assess principal groundwater flow directions and hydraulic gradients; and
- collection of representative groundwater samples from the newly installed groundwater monitoring wells to assess water quality and definition of the overall extent of the groundwater contaminant plume.

1.3 Site Description and History

The geographical areas where fieldwork is to be performed will consist of:

- The RV Fam Camp Area including the abandoned sewage collection system and associated leach field.
- The area in the immediate vicinity of the JP4 distribution line. This area extends along the length of the distribution line which begins at the base near Ascol Drive at the north end of the golf course and continues across the golf course. The line exits the base near the intersection of White Settlement Road and Highway 183, and runs along Highway 183 for approximately 1,500 linear feet to the end of U.S. Air Force property. Actual property lines and linear footage are to be established by TEC during premobilization survey activities.

1.3.1 Site Description

NAS Fort Worth is located in north-central Texas in Tarrant County, 8 miles west of downtown Fort Worth. The station property, totaling 2,555 acres, consists of the main station and two non-contiguous parcels. The main station comprises 2,264 acres and is bordered by Lake Worth to the north, the West Fork of the Trinity River and Westworth Village to the east, Fort Worth to the northeast and southeast, White Settlement to the west and southwest, and Air Force Plant 4 to the west. The area surrounding NAS Fort Worth is mostly suburban, including the residential areas of the cities of Fort Worth, Westworth Village, and White Settlement.

The climate in the Fort Worth region is sub-humid with mild winters and hot, humid summers. The average annual precipitation is 31.5 inches, with the majority falling between April and October. The average annual temperature is 66 degrees Fahrenheit (°F). July is the hottest month with an average monthly temperature of 86 °F, while January is the coldest month with an average monthly temperature of 45 °F. The temperature can vary 20° to 30° in several hours. The average annual relative humidity is 63 percent.

Prevailing winds are primarily southerly from March through November and northerly from December through February; the average wind speed is eight knots. Severe thunderstorms with wind speeds of 65 knots and hail storms are common. Climate conditions in summer make tornado formations possible, although there is more property damage each year resulting from hail than tornadoes.

1.3.2 Site History

In 1984, the IRP was initiated at NAS Fort Worth and began with a program records search conducted by CH_2M Hill, Inc. Since 1984, Air Force IRP studies have been conducted by several contractors that have focused on identifying and characterizing waste disposal areas and solid waste management units (SWMUs) identified in the Installation's Resource Conservation and Recovery Act (RCRA) Part B permit.

NAS Fort Worth currently has 19 active IRP sites; however, it should be noted that the project area is not an IRP site. The purpose of this investigation is to confirm the presence or absence of contamination and to determine its nature and extent with the intent to eventually turn over the property to other parties free of contamination.

2.0 PROJECT PERSONNEL

The overall organizational structure for TEC's Health and Safety Program appears in Table 2-1, and is discussed below.

The major personnel involved in TEC's Corporate Health and Safety Program organization include the:

- President;
- Health and Safety Committee;
- Corporate Health and Safety Manager (CHSM);
- Project Health and Safety Managers (PHSMs);
- Regional/Subsidiary Office Safety Managers (OSMs); and
- Site Health and Safety Managers (SHSMs).

Descriptions of the roles and responsibilities accorded to each of these elements are detailed in the TEC Health and Safety Policy Manual.

The Project Health and Safety Manager (PHSM) has distinct technical and financial management authority from general project management. Health and safety management authority is delegated from the TEC Corporate Health and Safety Manager (CHSM) to the PHSM who has authority over this project.

The PHSM has absolute authority to halt the execution of this project for any nonconformance with the health and safety policies detailed in this HSP. This authority is subject to concurrence by the CHSM. The PHSM must approve field activities prior to execution at the job site.

2.1 Safety Organizational Structure

The following table lists principal project personnel and corresponding telephone numbers.

Table 2-1 Principal Project Personnel

Title	Name	Phone Number
CHSM	Alistair Downie	(804) 295-4446
Project Manager	Glenn Metzler	(804) 295-4446
AFCEE COR	Charles Rice	(210) 536-6452
Base Conversion Agency Coordinator	Olen Long	(817) 731-8284
Base Engineering Technician	Alan Flolo	(817) 731-8973, ext. 18
PHSM	Glenn Metzler	(804) 295-4446
Alternate PHSM	Chris McQuale	(804) 295-4446
SHSM	Dave Di Cesare	(804) 295-4446
Alternate SHSM	Donald Coleman	(804) 295-4446

CHSM = Corporate Health and Safety Manager
COR = Contracting Officer's Representative
PHSM = Project Health and Safety Manager
SHSM = Site Health and Safety Manager

2.2 Personnel Responsibilities

In general, the Project Manager is responsible for ensuring that the TEC staff is aware of appropriate health and safety procedures, and thus ensuring that projects are performed with the utmost regard for the health and safety of all personnel involved. All staff members have a responsibility for accident prevention by following established safety procedures necessary to perform assigned work without injury. Violations which endanger employees, subcontractors, or third party lives, health, or welfare, are not tolerated.

The prime responsibility for ensuring that health and safety procedures and policy are adhered to within the project framework is assigned to the PHSM, with support from the CHSM. The responsibilities of the CHSM are addressed in the TEC Health and Safety Policy Manual.

General health and safety authority for TEC employees and subcontractors belongs to the CHSM. Day-to-day health and safety authority is delegated to the PHSM. The CHSM is responsible for ensuring that the TEC Health and Safety Policy Manual has been implemented in all TEC projects including the project for which this HSP is developed. The CHSM resolves issues that cannot be resolved by the PHSM.

The PHSM is responsible for:

- making decisions necessary for implementing and enforcing policies contained in this HSP;
- ensuring that all project personnel are aware of, and comply with, the provisions of this HSP;
- halting the project for noncompliance with this HSP;
- auditing for compliance with the policies and procedures detailed in this HSP;
- training and re-training of personnel as necessary;
- coordinating with subcontractor health and safety personnel; and
- ensuring that subcontractors comply with this HSP.

To provide the most cost-effective and safe field operations, a Site Health and Safety Manager (SHSM) will be assigned to the job site. The SHSM will be named by the Project Manager subject to approval by the PHSM. Unless it is determined that the activities associated with a particular work assignment warrant the use of a full-time health and safety professional, the SHSM will be selected from the members of the assigned project team. The SHSM will be responsible for implementing this HSP, in addition to his/her regular responsibilities.

The SHSM will designate, with concurrence from the PHSM, an alternate SHSM when necessary. Designation of alternate SHSMs will be documented in the Field Log Book. The SHSM's and/or designated alternate's responsibilities include the following:

- rig inspections;
- calibration, setup, and maintenance of appropriate monitoring devices;
- selection of Personal Protective Equipment (PPE);
- monitoring daily weather conditions;
- coordination and conduct of daily tailgate meetings;
- proper emergency notification of station and AFCEE personnel;
- oversight of contractor and subcontractor field personnel;
- investigation of accidents and injuries; and
- authority to stop work fieldwork if deemed necessary.

2.3 Safety Training

This section provides a brief description of the TEC hazardous waste health and safety training program. Consistent with Occupational Safety and Health Administration (OSHA) regulations (29 CFR 1919.120), no individual will engage in hazardous waste field activities until they have been trained to conduct those activities commensurate with the degree of anticipated hazards. All TEC personnel participating in this project will have received the following health and safety training:

- OSHA health and safety training;
- standard first aid; and
- standard CPR.

The training presented as part of the TEC program provides various levels of training depending on the hazard(s) at a specific site. Basic training provides, at a minimum, an understanding of:

- the SOPs to be followed at hazardous waste sites;
- the potential hazards which may be encountered at hazardous waste sites, and potential consequences of exposure to those hazards;
- the procedures to effectively deal with hazards to minimize risk of adverse impact on the health and safety of employees, subcontractors, and third parties; and
- the purpose and limitations of safety equipment.

Health and safety training (along with Medical Clearance and Respirator Clearance), is a requirement to obtain Site/Activity Clearance. Respirators will be used only by authorized personnel who are properly trained and fit tested for the specific respirator. A complete description of the requirements of the Respirator Clearance program is included in the TEC Health and Safety Policy Manual.

The following is a representative outline of a 40-hour training course taken by TEC personnel:

- Overview of CERCLA, SARA, RCRA, and OSHA regulations;
- Physical/Chemical Hazard Recognition;
- Levels of Protection;
- Personnel Exposure Guidelines;
- Sources of Information;
- Hazard Recognition/Evaluation (Problem);
- Monitoring Instruments (Workshop);
- Heat/Cold Stress;
- Protective Clothing;
- Respiratory Protection: Introduction and Use (Exercise);
- Health and Safety Plans (Exercise);
- Field Operations (Problem);
- Personnel Decontamination (Demonstration);
- Field Operations (Exercise); and
- Certification Examination.

OSHA regulations require 8 hours of refresher training on an annual basis. TEC personnel participating in this project must complete refresher training annually.

The most relevant training for hazardous waste work is on-the-job training (OJT). This is a system whereby less experienced field personnel participate in actual field activities under the direction of more experienced personnel. Twenty-four hours of OJT under the direction of a trained supervisor as part of pre-assignment health and safety training is required by OSHA. OJT is a requirement to qualify for supervisory training.

Additionally, OSHA regulations require that 8 hours of hazardous waste site management training be provided to hazardous waste site supervisors, (i.e., to the SHSM and PHSM). Health and Safety Managers (HSMs) for this project will be trained in compliance with applicable OSHA regulations.

No TEC employee will participate in this project unless he/she has been trained in the provisions of the TEC Health and Safety Policy Manual and has practiced job assignments in non-hazardous situations.

2.4 Medical Monitoring Program

Sections 4.0 and 5.0 of the TEC Health and Safety Policy Manual describe the TEC Corporate Medical Monitoring Program. Strict compliance with the specified administrative and medical procedures and protocols is mandatory.

Medical monitoring is an integral component of occupational health and safety programs. The intent of the Medical Monitoring Program is to monitor the health of individual project personnel through the use of initial and periodic medical examinations and diagnostic testing.

This program allows the occupational physicians to:

- certify individuals to work on hazardous waste projects as required by OSHA regulations;
- establish a baseline for evaluating any future changes in health or physical well being;
- identify any underlying illnesses or conditions which might be aggravated by certain exposures or job activities; and
- recognize any abnormalities, toxic reactions, or other changes at the earliest opportunity so that corrective measures may be taken.

The PHSM or SHSM will authorize individuals to access areas where site control is established (to conduct fieldwork in accordance with this HSP only) if current certification of medical fitness, training, and respirator fit are in accordance with OSHA Regulations. Copies of certifications will be on file.

Employees of subcontractors will provide documentation of their participation in a medical surveillance program before the start of fieldwork. Documentation will be maintained in the project files.

Before being assigned to a hazardous or potentially hazardous activity involving exposure to toxic materials, each TEC employee will receive a pre-assignment or baseline physical examination, as suggested by the National Institute for Occupational Safety and Health (NIOSH)/Occupational Safety and Health Administration (OSHA)/U.S. Coast Guard/U.S. Environmental Protection Agency (EPA) *Occupational Safety & Health Guidance Manual for Hazardous Waste Site Activities* (U.S. Department of Health and Human Services 1985).

The minimum medical monitoring requirements for work at NAS Fort Worth are as follows:

- complete medical and work histories;
- physical examination;
- pulmonary function test, forced vital capacity and forced expiratory volume;
- chest X-ray;
- electrocardiogram;
- eye examination and visual acuity;
- audiometry;
- urinalysis; and
- blood chemistry, including hematology and serum analyses.

The pre-assignment physical examination categorizes employees as fit for duty and able to wear respiratory protection. In addition to the baseline physical examination, all employees will obtain an annual physical exam. Although drug and alcohol screening are not part of the TEC Medical Monitoring Program, the TEC Employee Handbook specifically addresses drug and alcohol use. The unlawful manufacture, possession, distribution, transfer, purchase, sale, use, or being under the influence of alcoholic beverages or illegal drugs while on site, while attending business-related activities, while on duty, or while operating a vehicle or machine leased or owned by TEC is strictly prohibited and may lead to disciplinary action, including suspension without pay or discharge. When appropriate, TEC may refer the employee to approved counseling or rehabilitation programs. TEC will request documentation from project subcontractors of their existing drug and alcohol screening policies.

All personnel working in contaminated or potentially contaminated areas at NAS Fort Worth have current medical monitoring (within 12 months). TEC will maintain documentation for subcontractors on file specifying that all employees are fit for duty. Each certificate will be signed by an attending physician.

2.5 Subcontractors

Subcontractors and their employees must comply with:

- all applicable OSHA standards;
- other Federal, State, and local ordinances, statutes, and regulations;
- safety practices standard in their industry; and
- safety procedures followed by the facility owner or operator.

The subcontractors to be utilized for fieldwork during this project include:

- driller;
- surveyor;
- geophysicist/utility locator; and
- site restoration personnel.

They will be required to work under the guidelines specified in this HSP. TEC will require that work practices performed by subcontractors meet the requirements of the HSP. To ensure compliance, the subcontractors will provide documentation to the PHSM verifying that field personnel have necessary respiratory approval and OSHA-mandated training. TEC will provide a copy of this HSP to subcontractors prior to the initiation of field activities. Each subcontractor must complete the Health and Safety Plan Agreement and Acknowledgment Sheet provided in Appendix L for all field personnel and submit the completed sheet to the PHSM.

The SHSM or designated alternate will be on site at all times to ensure subcontractor compliance with this HSP. TEC reserves the right to stop work and restrict personnel from working for non-compliance with the HSP.

If a subcontractor chooses to implement its own HSP, the plan shall be consistent with the requirements of:

1) *OSHA Safety and Health Standards 29 CFR 1910 (General Industry)* US Department of Labor, Occupational Safety and Health Administration. Hereafter, referred to as "29 CFR 1910." Available by calling 513-533-8236.

2) *OSHA 29 CFR 1910.120 Hazardous Waste Operations and Emergency Response.* Final Rule, U.S. Department of Labor. Occupational Safety and Health Administration, December, 1991. Hereafter referred to as "29 CFR 1910.120," it is attached to this section for reference (Attachment C).

3) *OSHA Safety and Health Standards 29 CFR 1926/1910 (Construction Industry),* US Department of Labor. Occupational Safety and Health Administration. 1985. Hereafter, referred to as "29 CFR 1926/1910."

4) *Standard Operating Safety Guidelines,* US EPA. Environmental Response Branch, Hazardous Response Support Division. Office of Emergency and Remedial Response, November, 1984. Hereafter referred to as "EPA Guidelines."

5) *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities,* US Department of Health and Human Services, Public Health Service, Centers for Disease Control. National Institute for Occupational Safety and Health. October, 1985.

2.6 Visitors/Trainees

Visitors/trainees entering this site are required to read and understand this HSP, and to verify their training and participation in a medical surveillance program to the PHSM. Forms in Appendices J and N must be read and signed by each visitor/trainee.

Once the signing of these forms is completed and the visitor is wearing the required PPE, the visitor may enter the exclusion zone. However, in most cases visitors will be limited to the contamination reduction zone or clean/support zone. Visitors/trainees will be escorted by a site representative.

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3.0 GENERAL HEALTH AND SAFETY RISKS

General health and safety risks will be discussed during tailgate meetings conducted by the SHSM or designated alternate. Tailgate meetings will be held daily at the field site prior to initiating field activities. The SHSM or alternate will discuss personnel responsibilities, planned investigation and presumed potential hazards, PPE, monitoring, emergency scenario plans, evacuation routes, and location/operation of kill switches, fire extinguishers, eye washes, and first aid kits.

The PHSM or SHSM shall arrange to have all health and safety posters and information conspicuously posted or readily available in a central location at the TEC field office. These shall include those listed below:

- TEC forms, including Site Tailgate Briefing Form (Appendix N) and Visitor/Trainee Agreement Form (Appendix M);
- OSHA forms and postings, including the following:
    - OSHA 200 Log;
    - OSHA Safety and Health Poster;
    - access to Medical and Exposure Records; and
    - OSHA permits as applicable.

3.1 Hazardous Materials and Site Contaminants

The suspected contaminants on site are listed in Table 3-1 and Table 3-2. Representative Material Safety Data Sheets (MSDSs) for these substances are provided as Appendix K to this HSP.

Exposure risks at the NAS Fort Worth field sites are expected to be greatest for on-site workers in direct contact with potentially contaminated media. Major mechanisms for potential exposure are via inhalation or skin absorption.

Chemical hazard procedures are provided in Appendix G for those chemicals that are typically used for sampling equipment decontamination.

There is potential for bites from insects, snakes, and rodents, as well as possible contact with poisonous plants. More detailed information concerning biological hazards and controls are also provided in Appendix G.

3.2 Physical Safety Hazards

Stress, as a physical hazard, can contribute significantly to accidents or can harm workers. Employees will use proper techniques during lifting and transport of investigative-derived waste (IDW). Employees will wear eye and ear hazards during this project. These hazards will be most prevalent during advancement of soil borings, installation of monitoring wells, and collection of soil and groundwater samples. Eyewash stations, ear plugs, and other precautionary measures will be provided to reduce potential worker hazards.

Table 3-1. Vapor Properties of Hazardous Compounds Potentially Existing on Site

Compound	CAS #	VP[1] @ 20 °C (mmHg)	Vapor Density[1] (air=1)	Respiratory Exposure Levels: TLV — TWA[4] (ppm)	Respiratory Exposure Levels: TLV — STEL[4] (ppm)	Odor Threshold[3] (ppm)	Explosive Levels — LEL[2] (%)	Explosive Levels — UEL[2] (%)	IDLH[2] (ppm)
Benzene	71-43-2	75	2.8	0.1	1	1.3	1.2	7.8	500
Ethyl benzene	100-41-4	10	N/A	100	125	140	1.0	6.7	800
Fuel oil	N/A	2	1	N/A	N/A	N/A	0.5-0.6	6-7.5	N/A
Gasoline	8006-61-9	350-800	3-4	300	500	0.25	1.5	7.6	N/A
Hydrogen sulfide	7783-06-4	>760	1.2	10	15	0.0047	4.3	46	100
Jet Fuels	N/A	104	N/K	N/A	N/A	1	1.3	8.0	N/A
Lead	7439-92-1	0	0	0.1	N/A	N/A	N/A	N/A	700
Motor oil	N/A	N/K	N/K	N/A	N/A	N/K	N/K	N/K	N/A
Toluene	108-88-3	22	3.2	50	150	0.17	1.0	7.0	500
Xylenes	1330-20-7	7-9	3.7	100	150	1.1	1.1	7.0	900

1 DoD, 1994.
2 NIOSH, 1994.
3 Weiss, 1980.
4 The more stringent value is selected from specified sources.

N/A = Not Available
N/K = Not Known
STEL = Short-Term Exposure Level
TLV = Threshold Limit Value
TWA = Time-Weighted Average
UEL = Upper Explosive Limit
VP = Vapor Pressure
IDLH = Immediately Dangerous to Life and Health
LDC = Lowest Detectable Concentration
LEL = Lower Explosive Limit

Table 3-2. Health Hazards of Hazardous Compounds Potentially Existing on Site

Compound	CAS #	Carcinogen	Physical Description[1]	Routes[1]	Symptoms[1]
Benzene	71-43-2	Yes	Colorless to light-yellow liquid with an aromatic odor.	Inhalation, Skin Absorption, Ingestion, Skin and/or eye contact	Irritates eyes, nose, respiratory system; giddiness; headache, nausea, staggered gait; fatigue, anorexia, lassitude; dermatitis; bone marrow depressant
Ethyl benzene	100-41-4	No	Colorless liquid with an aromatic odor.	Inhalation, Ingestion, Skin and/or eye contact	Irritates eyes, mucous membranes; headache; dermatitis; narcosis, coma
Fuel oil	N/A	N/K[2]	Clear bright liquid with parafinnic odor.	Inhalation, Ingestion	Irritates skin; harmful or fatal if swallowed.
Gasoline	8006-61-9	Yes[2]	Red-orange liquid with a pungent odor.	Inhalation, Skin Absorption, Ingestion, Skin and/or eye contact	Irritates eyes, nose, respiratory system; giddiness; headache, nausea, staggered gait; fatigue, anorexia, lassitude; dermatitis; bone marrow depressant
Hydrogen sulfide	7783-06-4	No	Colorless gas with a strong odor of rotten eggs.	Inhalation, Ingestion, Skin and/or eye contact	Apnea, coma, convulsions; irritates eyes: conjunctivitis, pain, lacrimation, photophobia, corneal vesiculation; irritates respiratory system; dizziness; headache; fatigue; irritability; insomnia; gastrointestinal disturbance
Jet Fuels	N/A	Yes[2]	Colorless liquid with fuel oil odor.	Inhalation, Skin Absorption, Ingestion, Skin and/or eye contact	Irritates eyes, nose, respiratory system; giddiness; headache, nausea, staggered gait; fatigue, anorexia, lassitude; dermatitis; bone marrow depressant
Lead	7439-92-1	No	Visibly unidentifiable in solution. Metal: soft gray ductile.	Inhalation, Ingestion, Skin and/or eye contact	Weakness, lassitude, insomnia; facial pallor; pal eye, anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis of wrist and ankles; hypertension; encephalopathy; kidney disease, nephropathy; irritates eyes

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Table 3-2. Health Hazards of Hazardous Compounds Potentially Existing on Site

Compound	CAS #	Carcinogen	Physical Description[1]	Routes[1]	Symptoms[1]
Motor oil	N/A	No[2]	Clear to amber color with mild bland petroleum odor.	Inhalation, Ingestion	N/R[2]
Toluene	108-88-3	No	Colorless liquid with a sweet, pungent, benzene odor.	Inhalation, Skin Absorption, Ingestion, Skin and/or eye contact	Irritates eyes, nose; fatigue, weakness; confusion, euphoria, dizziness, headache; dilated pupils, lacrimation; nervousness, muscle fatigue, insomnia; paresthesia; dermatitis
Xylenes	1330-20-7	No	Colorless liquids with an aromatic odor.	Inhalation, Skin Absorption, Ingestion, Skin and/or eye contact	Dizziness, excitement, drowsiness, incoordination, staggering gait; irritates eyes, skin, nose, throat; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis

1 NIOSH, 1994.
N/A = Not Available
N/R = Not Relevant

2 DoD, 1994.
N/K = Not Known

The term stress denotes physical (mechanical, heat, cold, pathogen, injury) and psychological (fear, anxiety, crises, joy) forces that are experienced by individuals. Appendix E contains more detailed procedures for recognizing common physical safety hazards such as stress or other common worksite physical safety hazards.

The most common types of stress that affect field personnel are heat stress and cold stress. Heat stress and cold stress may be the most serious hazard to workers at waste sites.

Heat Stress. Temperature and humidity are anticipated to be potentially serious hazards during this project as the temperature often approaches 100° F at Carswell Field during the summer. Regular monitoring and other preventative measures are vital. Appendix F contains more detailed procedures regarding heat stress.

Site workers must learn to recognize and treat the various forms of heat stress. The best approach is preventative heat stress management.

- **Have workers drink 16 ounces** of water before beginning work, such as in the morning or after lunch. Provide disposable, 4-ounce cups and water that is maintained at 50° F - 60° F. Urge workers to drink one to two of these cups of water every 20 minutes, for a total of 1 to 2 gallons per day. Provide a cool, preferably air-conditioned area for rest breaks. Discourage the use of alcohol during non-working hours as well as working hours, and discourage the intake of coffee during working hours; both alcohol and coffee dehydrate the body and could affect the body's natural cooling systems. Monitor for signs of heat stress.
- **Acclimate workers to site work conditions** by slowly increasing workloads, i.e., do not begin with extremely demanding activities.
- **Provide cooling devices** to aid natural body ventilation. These devices, however, add weight, and their use should be balanced against worker efficiency. An example of a cooling aid is long cotton underwear which acts as a wick to help absorb moisture and protect the skin from direct contact with heat-absorbing protective clothing.
- **Install mobile showers** and/or hose down facilities to reduce body temperature and cool protective clothing.
- **In hot weather**, conduct field activities in the early morning or evening.
- **Ensure that adequate shelter is available** to protect personnel against heat, as well as cold, rain, or snow, which can decrease physical efficiency and increase the probability of both heat and cold stress. If possible, set up the command post in the shade.
- **In hot weather, rotate shifts** of workers wearing impervious clothing.
- **Good hygienic standards** must be maintained by frequent changes of clothing and showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should immediately consult medical personnel.

Cold Stress. Severely cold temperatures are not anticipated.

3.3 Other Risks

The CHSM, PHSM, or SHSM will stop work activities for noncompliance with this HSP, or if job-site conditions become unsafe. Work activities can resume only after the deficiency has been corrected, and all issues have been resolved. In most instances, the resolution occurs at the project level. The responsibility for resolving conflicts lies first with the SHSM, and ultimately with the CHSM. The CHSM, PHSM, or SHSM shall also suspend participation of subcontractors in job-site activities for violating any provision of this HSP.

The CHSM, PHSM, or SHSM shall immediately advise the Project Manager of the reason(s) for suspending operations, and shall notify additional individuals, as necessary, of the action. The PHSM, CHSM, or SHSM may not suspend the operations of any parties not in a direct contractual relationship with TEC, such as the EPA or State personnel, or other construction, cleanup, or consulting firms; however, they shall make a good faith effort to inform these individuals of any unsafe practices or conditions they have observed.

Note that work of TEC and subcontractors shall be suspended if the CHSM, PHSM, or SHSM judges that there is potential harm to a third party, such as community residents.

3.4 Personal Protective Equipment (PPE)

This section provides a general description of PPE and the requirements for this project. Safe and efficient operations on hazardous waste projects require careful selection and use of protective clothing. The SHSM or designated alternate is responsible for determining the level of PPE required.

In selecting protective clothing, the following requirements should be met:

- **Chemical resistance**: the clothing must maintain its structural integrity and protective qualities.
- **Strength**: the clothing must be resistant to tears, punctures, and abrasions.
- **Flexibility**: the clothing must be easy to move and work in.

The two most significant effects of chemicals on protective clothing are **permeation**- the process by which a chemical moves through protective materials, and **degradation**- the loss of physical properties of the material. It is important to understand that a chemical may permeate a material without degrading the material. **Penetration** (the movement of chemicals through stitched seams, zippers, and other imperfections) is also significant.

For this project, use of Modified Level D PPE is anticipated. Modified Level D Protection includes:

- latex/nitrile gloves for some tasks;
- boots/shoes: leather or chemical-resistant, steel toe, and shank;
- standard work uniform and/or coveralls;
- safety glasses, recommended to be worn at all times;
- ear protection, where necessary; and
- hard hat, where necessary.

A complete description of the selection process for Modified Level D Protection is contained in the TEC Health and Safety Policy Manual. The following criteria for work conditions correspond to the requirement of Modified Level D Protection:

- contaminants are not present, or contaminants are present below levels where there is evidence of adverse health effects, such as below the Threshold Limit Value (TLV) or Permissible Exposure Level (PEL); and
- work functions preclude splashes, immersion, or potential for unexpected inhalation of any chemicals.

It should be noted that if more extensive contamination is encountered during field operations, selection of PPE should be reviewed and appropriate steps taken to ensure that worker safety is maintained. Level C PPE is described briefly below.

Level C Personnel Protective Equipment includes:

- air-purifying respirator, full-face, cartridge-equipped (MSHA/NIOSH approved);
- chemical-resistant clothing (coveralls; hooded, one-piece or two-piece chemical splash suit; chemical-resistant hood and apron; disposable chemical-resistant coveralls);
- coveralls;
- long cotton underwear;
- gloves (outer), chemical-resistant;
- gloves (inner), chemical-resistant;
- boots (outer), chemical-resistant, steel toe and shank;
- boot covers (outer), chemical-resistant (disposable);
- hard hat (face shield);
- escape mask; and
- 2-way radio communications (intrinsically safe).

Level C Protection is needed if all these criteria are met:

- oxygen concentrations are greater 19.5 percent by volume;
- measured air concentrations of identified substances will be reduced by the respirator below the substance's TLV or PEL and the concentration is within the service limit of the cartridge;
- atmospheric contaminant concentrations do not exceed IDLH levels;
- atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect any body area left unprotected by chemical-resistant clothing;
- job functions do not require a self-contained breathing apparatus; and
- continuous direct readings are a few parts per million (i.e., up to 5 ppm) above background in an unknown environment on instruments such as the FID or PID.

Chemical protective clothing greatly reduces body ventilation and diminishes the body's ability to regulate its temperature. Even in moderate ambient temperatures, the diminished capacity of the body to dissipate heat can result in one or more heat related problems.

Modified Level D protection is primarily a work uniform. It can be worn only in areas where there is no possibility of contact with contamination. Somewhat greater stress is associated with Level C Protection than with Modified Level D. Wearing protective equipment also increases the risk of accidents because it is heavy, cumbersome, decreases dexterity, and agility, interferes with vision, and is fatiguing to wear.

3.5 Air Monitoring

Routine ambient air monitoring for organic vapors will serve as the basis for selecting the appropriate level of PPE. Most ambient air monitoring will be performed during drilling operations and will focus on the breathing zone of on-site workers. PID measurements will be obtained at least hourly during intrusive site activities or as needed with changes in drilling or site conditions. Additional monitoring will be conducted periodically throughout the day at the hole and at open split-spoon samples. Air monitoring is required for field activities that significantly disturb surface soil and for verification that site control procedures (Section 5.0) are preventing the spread of contaminants, an ambient air monitoring program will be established. The support zone will be periodically monitored for air contaminants using a PID. Occasional wipe tests may be conducted in trailers and other areas used by personnel. These types of samples may be collected and monitored in the contamination reduction zone. Increased concentration of air or other environmental media may indicated ineffective decontamination procedures. The Work Plan for this project contains forms for recording air monitoring results and calibration data.

3.6 General Work Rules

Fieldwork will be conducted only during daylight hours unless adequate lighting is provided. The "buddy" system will be observed if site personnel are required to wear respiratory protection.

Entry and exit into the Exclusion Zone, Contamination Reduction Zone, and Support Zone will be restricted to authorized personnel. Personnel entering the Exclusion Zone must be wearing the required minimum PPE and must exit the area via the decontamination station (see Section 5.5).

Eating, drinking, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in any area designated contaminated. Contact lenses may not be worn in the Exclusion Zone. All field personnel requiring corrective lenses must provide their own prescription glasses and lenses that may be fitted into the respiratory masks.

Hands and faces must be thoroughly washed upon leaving the work area and before eating, drinking, or any other activity. A large supply of clean water will be available on site at all times.

No excessive facial hair, which may interfere with a satisfactory fit of the mask-to-face seal, will be allowed on personnel required to wear respiratory protective equipment. The SHSM will determine if facial hair presents such an interference.

Contact with contaminated or potentially contaminated surfaces shall be avoided. Field personnel will be instructed to avoid walking through puddles, mud, and other discolored surfaces, and to minimize equipment and personal contact with site soils whenever possible. Personnel assigned for on-site activities will be adequately trained and thoroughly briefed on anticipated hazards, equipment to be worn, safety practices to be followed, emergency procedures, and communications.

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4.0 FIELD OPERATIONS

The following subsections contain brief discussions regarding field operations. Operational procedures are detailed in Appendices A-D. At a minimum, the following topics are addressed in each Appendix:

- work practices;
- hazard identification;
- physical hazards;
- chemical and biological hazards;
- monitoring;
- required PPE; and
- handling of waste materials.

Major field operations anticipated in this project include:

- Soil Borings (Appendix A);
- Monitoring Well Installation/Development (Appendix B);
- Monitoring Well Purging/Sampling (Appendix C); and
- Soil Gas Probe Placement/Retrieval.

If additional field operations are required, this HSP will be modified as deemed necessary by the CHSM, PHSM, or SHSM. Field team members shall be required to inform project management of any modifications to planned field operations. As this HSP is modified, project personnel will read the modifications and document their review of HSP modifications.

Table 4-1 briefly summarizes each field operation. Level of effort (including required personnel and duration), task description, and type of waste are included.

Table 4-2 contains summaries of selected requirements for field operations. Detailed information is contained in the Appendices.

Table 4-1 Field Operation Task Descriptions and Requirements

Field Operation	Required Personnel	Estimated Duration (days)	Type of Waste	Description
Soil Boring	Hydrogeologist Geologist	2.0	Soil cuttings Groundwater	Licensed geologist, hydrogeologist, or geotechnical engineer will supervise drilling. There is a possibility that floating petroleum products will be encountered. Hollow stem auger drilling techniques will be used.
Monitoring Well Installation/Development	Hydrogeologist Geologist	5 *	Soil cuttings Groundwater	Licensed geologist, hydrogeologist, or geotechnical engineer will supervise installation/development. There is a possibility that floating petroleum products will be encountered; therefore shallow monitoring wells will be screened across the water table. All monitoring well installations will be designed to conform to state and local regulations.
Monitoring Well Purging/Sampling	Hydrogeologist Geologist	5 *	Groundwater	Purging will be performed to evacuate water that has been stagnant in the well and may not be representative of aquifer conditions. Following removal of three well volumes and stabilization of temperature, pH, and electrical conductivity, sampling will proceed. If these variables do not stabilize, three additional volumes will be removed and sampling will proceed.
Soil Gas Probe Placement/Retrieval	Hydrogeologist Engineer/Tech	5	Surface and subsurface soils	Gore-Sorber® Passive Sorbent Collection Devices (sorbers) will be placed to conduct the soil gas survey. Sorbers will be installed at 50-foot intervals directly above the centerline of the JP4 distribution line. A slam bar or electric rotary hammer will be used to install the sorbers in 3/4 inch to one inch diameter pilot holes.

* Assumes installation of six 30-foot groundwater monitoring wells.

Table 4-2 Field Operation Health and Safety Requirements

Field Operation	Air Monitoring Type	Air Monitoring Frequency	Required PPE Level	Critical PPE	Possible Hazards
Soil Boring	PID	Hourly	Modified Level D	Safety glasses, ear plugs[1], latex/nitrile gloves, steel-toed safety shoes, hard hat	Electrical hazards, drilling rig and associated drilling equipment such as auger flights and drill rods, noise, heavy lifting, dust, exposure to chemical contaminants
Monitoring Well Installation/ Development	PID	One well bore volume	Modified Level D	Safety glasses, latex/nitrile gloves, steel-toed safety shoes, hard hat	Electrical hazards, drilling rig and associated drilling equipment such as auger flights and drill rods, noise, heavy lifting, exposure to chemical contaminants
Monitoring Well Purging/Sampling	PID	One well bore volume	Modified Level D	Safety glasses, latex/nitrile gloves	Heavy lifting, exposure to chemical contaminants
Soil Gas Probe Placement/Retrieval	None	N/A	Modified Level D	Safety glasses, latex/nitrile gloves, steel-toed safety shoes	Heavy lifting, exposure to chemical contaminants

[1] Only during hammer operation.

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5.0 SITE CONTROL

Access control and decontamination at hazardous waste sites and operations are essential for maintaining the health and safety not only for workers but also for the community.

The field activities required for responding to environmental incidents involving hazardous substances may contribute to the movement of materials (contaminants) to unaffected areas. Response personnel and equipment may become contaminated and carry the material into clean areas. Material may become airborne due to its volatile nature; disturbed contaminated soil may become wind blown.

Contamination control procedures will be used to minimize the transfer of hazardous substance(s). Two methods will be used: establishment of work zones (access control) and removing contaminants from on-site personnel and equipment (decontamination). Decontamination procedures are discussed in Section 5.5 and 5.6.

Access is limited and control and security are provided by base security personnel in the areas of NAS Fort Worth where the work will take place. TEC's responsibility for access and control will be limited to the actual physical location where fieldwork is occurring. Barrier tape will be used to properly delineate areas where intrusive investigations are conducted. As required, field operations may extend beyond Carswell Field property. Access to these areas will be requested; the areas will be marked with barrier tape as necessary for intrusive investigations.

The SHSM has the following site control responsibilities:

- limit access to the sampling location(s) and post appropriate warning signs or caution tape, where required;
- ensure that "buddy system" requirements of 29 CFR 1910.120 are followed;
- keep a copy of this HSP readily available for on-site field personnel and visitors;
- establish on-site communications consisting of the following:
    - line of sight,
    - agreed-upon hand signals or two-way radio, and
    - air horn or other available alarm;
- establish off-site communications using two-way radio and/or telephone;
- set a wind indicator to readily determine wind direction;
- establish and delineate contiguous work zones (exclusion, contamination reduction, and clean/support), the latter two zones should be upwind of the exclusion zone unless obstacles make it unfeasible; and
- establish decontamination and waste disposal procedures.

5.1 Site Access Restrictions

The job site must be controlled to minimize the possibility of exposure to any contaminants present, and their transport off site by personnel or equipment.

These problems will be reduced or eliminated in a number of ways, including:

- setting up security and physical barriers to exclude unnecessary personnel;
- minimizing the number of personnel and equipment on site to be consistent with effective operations;
- establishing control points to regulate access to work zones; and
- conducting operations in a manner to reduce the exposure of personnel and equipment and to eliminate the potential for airborne dispersion.

5.2 Off-Site Contamination Control

Zones on the site will be delineated where prescribed operations occur. Zones in this project may be contiguous or non-contiguous based on conditions and activities that will be conducted at the site. Movement of personnel and equipment between zones and onto the site itself will be limited by access control points.

By these means, contamination will be expected to be contained within certain relatively small areas on the site to minimize its potential spread. Three contiguous zones will be used for full site operations:

1) the Exclusion Zone (minimum 10 foot radius from drill rig),

2) the Contamination Reduction Zone, and

3) the Clean/Support Zone.

Detailed descriptions of the development and maintenance of these zones are included in Appendix I.

The SHSM and/or PHSM will establish work zones prior to the performance of field operations. The work zones for this project are site-specific and have been established with careful consideration of site conditions (i.e., wind direction, site terrain, gradient).

5.3 Spill Containment

For detailed guidelines regarding spill containment, refer to the most current edition of the U.S. Department of Transportation (DOT) *Emergency Response Guide Book* (DOT P 5800.5), and to the Work Plan for this project. Potential spill sources during field operations include:

- hydraulic oil from motor vehicles and drill rigs;
- contaminated soils;
- decontamination liquids; and
- residual fuels from USTs or fuel distribution lines.

Containerizing materials as soon as possible will reduce the potential for spills. Handling of waste materials and containers will be in accordance with the Work Plan developed for NAS Fort Worth.

If spills occur, the PHSM and SHSM will be notified immediately. The PHSM and SHSM will be responsible for ensuring that necessary notifications are given to the CHSM and the AFCEE representative. The AFCEE representative will inform the station emergency responders if necessary. The AFCEE representative and TEC will determine the strategy for notifying regulatory agencies.

The following materials and equipment will be available for spill containment:

- additional DOT drums;
- absorbent materials (granular, rolls, sheets, booms);
- shovels and towels; and
- plastic sheeting.

5.4 Communication Procedures

To satisfy the training and hazard communication OSHA requirements of 29 CFR 1910.120, field team members shall be provided with a copy of this HSP and shall agree to abide by it by signing the agreement sheet in Appendix L. Field team members agree to inform the PHSM or SHSM of any immediate or potential hazards and take any precautionary measures to ensure proper safety. All preventative measures taken for potential and immediate hazards will be logged in a log book.

The PHSM and/or SHSM shall conduct a health and safety briefing before authorizing individual access to areas where site control is established. The SHSM shall document attendance and the topics discussed, including at least the following:

- work plan and individual assignments;
- potential hazards of the work to be performed (Section 3.0 and Appendices A-C);
- site controls and air monitoring action levels that will be in effect on site;
- PPE to be used;
- communication procedures, including evacuation/emergency signals; and
- emergency response/contingency plan and rescue operations (Section 6.0).

The PHSM and/or SHSM shall conduct daily health and safety tailgate meetings before field team personnel perform fieldwork. The SHSM shall document attendance (using the form in Appendix N) and the topics discussed, including at least the following:

- any potential hazards of the work to be performed that were not previously discussed;
- discussion and resolution of any health and safety concerns or problems since the previous tailgate meeting; and
- evacuation routes and emergency signals warnings.

5.5 Personnel Decontamination Procedures

Detailed decontamination procedures are contained in Appendix H. Personnel involved in this project may become contaminated in a number of ways, including:

- contacting vapors, gases, mists, or particulates in the air;

- being splashed by materials while sampling or opening containers, or during monitoring well installation/development;
- walking through puddles of liquids or on contaminated soil; and
- using contaminated instruments or equipment.

Protective clothing helps prevent the wearer from becoming contaminated or inhaling contaminants; good work practices help reduce accumulation of contaminants on protective clothing, field instruments, and equipment.

Even with these safeguards, contamination may occur. Harmful materials can be transferred into clean areas, exposing unprotected personnel. In removing contaminated clothing, personnel may contact contaminants on the clothing and/or inhale them. To prevent such occurrences, methods to reduce contamination will be developed as well as decontamination. These procedures and methods will be implemented before anyone enters a site and must continue (and be modified when necessary) throughout this project.

Modified Level D decontamination procedures will be used during this project (Level C procedures will be used if necessary and are detailed in Appendix H). The initial decontamination plan is based on an evaluation of specific conditions at the site including the:

- type of contaminant;
- amount of contamination;
- levels of protection required (Modified Level D); and
- type of protective clothing worn.

A system will be established to dispose or wash and rinse (at least once) all PPE coming in contact with soils or water generated at the site. Wearing disposable boot covers and gloves will eliminate washing and rinsing of both gloves and disposable boots and reduce the number of stations needed.

Equipment: long-handled soft-bristled brushes, wash tubs or equivalent, pump-activated sprayer, garbage cans with plastic liners and drums with liners, plastic sheeting, paper towels and duct tape

Decontamination Solution: detergent; tap water for rinsing.

Decontamination Procedures: two stages of decontamination have been designated.

- *Intermediate*: for periodic exits out of the exclusion zone during sample transport/management.
    - *Steps*: glove wash with detergent, rinse, removal of glove and storage for later use, entering transition zone for sample management, return to exclusion zone wearing new or cleaned gloves.
- *Final*: for use prior to taking breaks/lunch and exiting the site.
    - *Steps*: disposal (if not cleaned to "like new" condition) of gloves in designated receptacles, and general field wash for personal hygiene.

The initial decontamination plan will be modified to eliminate unnecessary stations, or should otherwise be adapted to site conditions.

At a minimum, the following information must be logged into a field log book to demonstrate that decontamination procedures are performed properly:

- date;
- site location;
- deviations from routine decontamination procedures;
- type of equipment decontaminated (manufacturer's name, model, and serial number as applicable);
- special or unusual conditions or problems (e.g., wind or ambient air conditions).

5.6 Equipment Decontamination Procedures

Specified procedures will be used to decontaminate soil and groundwater sampling equipment to prevent cross contamination of samples. These procedures will conform with AFCEE protocols for sampling equipment decontamination. Detailed procedures are contained in Appendix H.

All heavy equipment and metal sampling equipment used to collect samples for organics or metals analysis will be decontaminated. Procedures are detailed in the FSP. Heavy equipment in direct contact with soil and/or groundwater, such as the drill rig augers, shall be steam cleaned on site and be inspected by the Site Manager prior to leaving the site. The decontamination area will be designated by TEC.

Information as described in Section 5.5 will be entered into the field log book to document the decontamination.

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6.0 EMERGENCY RESPONSE PLAN

The PHSM or SHSM will perform the applicable emergency planning tasks before starting field activities and coordinate emergency response with the facility and local emergency service providers as appropriate. The PHSM or SHSM will:

- evaluate and document capabilities of local NAS Fort Worth emergency response teams, if any;
- verify local emergency contacts, hospital routes, evacuation routes, and assembly points;
- notify appropriate emergency responders listed in Section 6.2 before site mobilization;
- confirm and post emergency telephone numbers and route to hospital;
- post site map marked with location of emergency equipment and supplies;
- drive and verify route to hospital;
- designates one vehicle as the emergency vehicle; place a copy of this HSP, including the hospital directions and map, inside the vehicle; keep keys in ignition during field activities;
- inventory and check site emergency equipment and supplies;
- establish emergency signals, evacuation routes, and on-site and off-site assembly points;
- review emergency procedures for personnel injury;
- review names of on-site personnel trained in first aid and CPR;
- review emergency response and post-emergency notification procedures;
- rehearse the emergency response plan once before site activities;
- point out to field team members where emergency response equipment is located in the support area; and
- brief new workers on the emergency response plan.

In the event that investigation results indicate potential imminent health risk to the public at large or contracted or Federal personnel, the Contracting Officer's Representative (COR) and the base Point of Contact (POC) shall be notified via telephone. Written notification and supporting documentation will be provided within 3 days following initial notification.

6.1 Emergency Procedures

Adverse Weather or Natural Disasters

The SHSM or designated alternate will remain aware of current weather conditions by monitoring reports and current conditions daily and sometimes more frequently, if necessary. The SHSM may halt fieldwork if impending or current conditions warrant. If weather conditions require evacuation, the steps detailed under **Evacuation** will be followed.

Adverse weather conditions in the Fort Worth area include, but are not limited to:

- severe thunderstorms;
- hailstorms; and
- tornadoes.

These conditions are seasonal and the SHSM will be aware of when their occurrence is most likely. TEC will have a radio and/or barometer available to routinely monitor weather conditions. Electrical storms within hearing range of the job site will signal termination of work. Work will not continue until the SHSM or their alternate notifies personnel otherwise.

Evacuation

If an evacuation is necessary, the steps below shall be followed.

- Personnel are to leave the work location (upwind) and assemble at a designated assembly point (if safe) upon detecting the emergency signal for evacuation.
- If an emergency situation is of concern to local station personnel, the PSHM or SHSM shall notify the local station contact(s) of the emergency situation.
- If appropriate and safe, the PHSM or SHSM and a "buddy" are to remain at or near the sampling location after the location has been evacuated to assist local responders and advise them of the nature and location of the incident.
- The PHSM, SHSM, or designee is to account for field team members at the assembly point.
- The PHSM or SHSM is to complete an Preliminary Incident Report (Appendix O) as soon as possible after occurrence.

During an emergency, to signal evacuation, a vehicle horn will sound five 3-second blasts; each blast will be separated by 1 second.

A streamlined decontamination procedure to be used in the event of an evacuation will be prepared and practiced. Evacuation procedures will also be developed and the SHSM and/or PHSM will ensure that each site worker is aware of and follows evacuation procedures.

Medical Emergencies

If an employee working in a contaminated area is injured or exposed, the following steps will be taken:

- move the employee to a clean area (on a stretcher, if needed);
- call for the necessary emergency medical response services (ambulance, fire department, hospital, or poison control center) as detailed in the HSP;
- remove contaminated clothing (if possible);
- administer first aid, if you are qualified and if the situation warrants it;
- evacuate other persons threatened by the condition; and
- arrange transportation to local emergency medical facility.

Emergency first aid treatment will be administered only by trained individuals, and only to prevent further injury until professional treatment can be obtained.

The SHSM will be trained in standard first aid and CPR. The emergency systems detailed in the HSP will be verified prior to the startup of field activities.

The following first aid equipment will be provided at each work site:

- *American National Red Cross First Aid Handbook*;
- first aid kit;
- portable eyewash unit; and
- soap or waterless hand cleaner and towels.

Chemical Exposure

If the injury to the worker is chemical in nature (e.g., overexposure), the injury will be assessed and the appropriate response taken.

The following first aid procedures are to be instituted as soon as possible.

- **Eye Exposure** - If a contaminated solid or liquid gets into the eyes, wash eyes immediately at the emergency eyewash station using large amounts of water and lifting the lower and upper eyelids occasionally. Obtain medical attention immediately.
- **Skin Exposure** - If a contaminated solid or liquid gets on the skin, remove contaminated clothing and wash the contaminated skin promptly using soap or mild detergent and water. Obtain medical attention immediately if there are any symptoms of exposure.
- **Breathing** - If a person inhales large amounts of a gas or vapor, move him/her to fresh air at once. If he/she cannot breathe, provide artificial respiration. Keep the affected person warm and at rest. Obtain medical attention immediately.
- **Swallowing** - If a contaminated solid or liquid has been swallowed contact the Poison Control Center shown on the HSP. Obtain medical attention immediately.

Severe Chemical and Physical Injuries

Reducing risks of injury will be a priority; however, potential for serious injury will always exist on a job site where heavy equipment is being used. Statistically, injury rates are higher for persons involved in certain activities. Injuries, like disease, are predictable, preventable events resulting from the interaction of individuals and potential hazards. The policy of TEC is for its employees to be properly trained and aware of the potential hazards and more importantly to avoid injury-threatening situations. In cases where accidents do result in injury, TEC personnel are trained in Standard CPR and First Aid so that they may properly handle instances of severe injuries.

Field personnel should be aware that the potential exists for severe injuries including the following:

- burns;

- seizures and fainting;
- wounds;
- shock;
- sprains, strains, and breaks; and
- spinal cord injury.

Familiarity with the identification of symptoms and treatment of these and other severe injuries is paramount in successful treatment. An *American Red Cross Standard First Aid* handbook will be available on site for personnel review at all times.

Explosion And Fires

In the event of an explosion or fire at the site, the SHSM will take the following minimum actions.

- Evacuate all unnecessary personnel to the prearranged assembly point.
- Request emergency response assistance from the fire department, hospitals, and poison control centers.
- Notify the PHSM of the incident.

Telephone numbers for the emergency agencies are listed in Table 6-1 in Section 6.3. This list will be displayed at the TEC field office in an easily identifiable location.

6.2 Emergency Equipment

The following emergency equipment and supplies will be kept on site:

- 20-pound ABC fire extinguisher (or equivalent);
- industrial first aid kit;
- one-way breathing shield for CPR;
- rubber gloves (latex or other);
- water and electrolyte replenishers (Gatorade®);
- two-way radio(s) or cellular phone;
- wind direction indicator;
- portable eyewash/shower; and
- sorbent material or spill containment supplies.

6.3 Emergency Contacts

The TEC 24-hour health and safety emergency support number has been established to provide emergency health and safety, medical, and toxicological support and advice to TEC field personnel. Immediate medical emergencies such as exposures and injuries are to be handled via the emergency systems established for the particular project. Table 6-1 contains telephone number for emergency contacts, organizations, and local hospitals.

The 24-hour number provides additional information and support. This number is to be used for **health and safety emergencies only**; routine matters such as health and safety clearance are to be handled through normal channels during business hours.

Table 6-1 Emergency Information

Contact	Name	Phone
TEC 24-Hour Emergency Line	N/A	(Pending)
CHSM	Alistair Downie	(804) 295-4446
PHSM	Glenn Metzler	(804) 295-4446
SHSM	Dave Di Cesare	(804) 295-4446
Project Manager	Glenn Metzler	(804) 295-4446

Organization	Phone
Ambulance, Fire, and Police Emergency	911
Local Fire Department/Ambulance Service	(817) 738-3694
Fort Worth Police Department	(817) 335-4222
NAS Fort Worth Fire Department	(817) 782-6330
Texas Water Commission, Industrial and Hazardous Waste Div.	(512) 463-7761
State Police	(817) 370-6556
North Texas Poison Control Center	(800) 441-0040
USEPA Environmental Response Team	(201) 321-6660
US Coast Guard Environmental Response Team	(800) 424-8802
Monsanto Chemical Emergency Response	(618) 271-5835
Association of American Railroads Response Team	(202) 293-4048
CHEMTREC	(800) 424-9300
Dow Chemical Emergency Response	(517) 636-4400
DuPont Chemical Emergency Response	(302) 774-1000
National Foam Center Emergency Response	(215) 363-1400

Table 6-1 Emergency Information (continued)

Medical Emergency

Hospital Name	Harris Methodist Fort Worth Hospital
Hospital Address	1300 Pennsylvania Avenue Fort Worth, Texas 76104
Telephone Number	(817) 882-2000
Emergency Room	(817) 882-2000
Distance	Approximately 12 miles
Directions	From NAS Fort Worth, take Highway 183 south to I-30 east. Exit at Henderson Street. Proceed south on Henderson Street to Pennsylvania Avenue. The hospital is on the corner of 6th Street and Pennsylvania Avenue.

7.0 HEALTH AND SAFETY PLAN QUALITY ASSURANCE/QUALITY CONTROL

Quality Assurance/Quality Control (QA/QC) procedures are established to ensure project health and safety. Periodic auditing will occur to ensure that proper records are maintained regarding incident reporting.

The purpose of the incident reporting system is two-fold: to learn from past experiences, to maintain a safe work environment, and document occupational injuries and illnesses as required by OSHA. It consists of Monthly Incident Status Reports and Preliminary Incident Reports. All incidents involving occupational injury, illness, or exposure are thoroughly investigated, as are incidents that did not cause injury, illness, or exposure, but had the potential to do so ("near miss incidents").

This section discusses means of minimizing incidents that lead to injury, illness, or exposure. Emergency preparedness minimizes the consequences of such incidents if they occur.

OSHA and TEC record keeping requirements will be met. TEC project personnel are also required to maintain logs and daily reports (e.g., training logs, calibration logs, and daily tailgate information). The following forms are provided as attachments to this HSP and shall be maintained as documentation for demonstrating adherence to the HSP.

- Appendix L: Agreement and Acknowledgment Sheet
- Appendix M: Visitor/Trainee Agreement Form
- Appendix N: Site Tailgate Briefing Form
- Appendix O: Preliminary Incident Report

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8.0 REFERENCES

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U.S. Air Force. 1993 (September). *Handbook for the Installation Restoration Program (IRP) Remedial Investigations and Feasibility Studies (RI/FS).* Brooks Air Force Base, Texas 78235-5328. Headquarters, U.S. Air Force Center for Environmental Excellence.

U.S. Army Corps of Engineers. 1992 (October). *Safety and Health Requirements Manual.* EM 385-1-1.

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APPENDIX A

PROCEDURES FOR SOIL BORING
(Hollow Stem Auger)

APPENDIX A
PROCEDURES FOR SOIL BORING
(Hollow Stem Auger)

Soil borings will be advanced through overburden soils using a conventional truck-mounted drill rig. Borings will be completed using "dry" hollow-stem auger techniques from which soil samples will be taken. General hazards associated with borehole advancement include noise, electrical, chemical, heavy lifting, and use of heavy equipment. They are discussed in the following paragraphs

Electrical Hazards

Electrical hazards include electrical wires, buried cables, and generators; all pose a danger of shock or electrocution if contacted or severed during borehole advancement. Electrocution is the most common cause of job-related mortality for drillers and helpers. Contact with overhead wires or drilling into buried cables constitute the majority of cases; line arcing has been implicated in a few cases. To minimize electrical hazards, low-voltage equipment with ground-fault interrupters and water-tight corrosion-resistant connecting cables should always be used. A minimum of 20 feet should be maintained between drilling equipment and overhead wires. The distance may be increased depending upon local utility requirements and/or state and local regulations; distance requirements are often based on line voltage.

Underground utilities will be located before drilling operations commence. This will be through review of plans or geophysical methods. If soil borings are advanced in off-site locations, local utilities will be contacted regarding the location of buried cables.

Physical Hazards

Physical hazards include unstable slopes, uneven terrain, holes and ditches, steep grades, and mud-covered surfaces. The very act of drilling increases the slip/trip hazard by creating wet working surfaces. Wearing protective equipment, if required, further increases the risk of physical and/or mechanical injury by decreasing hearing, vision, and agility. Constant vigilance is required to avoid injury produced by drilling tools, support equipment, and motor vehicles. During actual drilling operations TEC personnel will maintain a minimum distance of 10 feet from the auger and the cathead. Specific hazards from drilling activities include, but are not limited to:

- fumes generated by drilling rig and vapors from contaminants;
- overhead utilites during installation and operations;
- rupturing of underground pipelines and utility lines;
- head injury due to free or falling parts from the cat head;
- moving parts such as augers catching clothing or impacting personnel;
- high pressure hydraulic lines and air lines; and
- lack of rig stability due to high winds, unstable or unlevel ground, or equipment malfunction such as failure of stabilizing plates or cracks in outriggers.

Good housekeeping around the site under investigation prevents accidents. Likewise, good maintenance of drilling equipment and proper use of hand tools can minimize the potential for personal injury and equipment loss. The drilling contractor shall demonstrate to TEC personnel that the emergency shut-off switch ("kill switch") is working properly. The kill switch is a steel cable that runs parallel to the base of the drilling platform and, when activated, shut off drilling operations.

All field personnel, including TEC personnel, shall be instructed by the drilling contractor as to its location and proper use. In addition, care will be exercised around wire line hoists and hoisting hardware, catheads, and rope hoists, as well as moving augers and rotary drill bits so that on-site personnel are not pulled into moving machinery or struck by objects.

In particular, soil cuttings exiting the borehole will be removed with a shovel, not kicked away by feet or hands. Soil cuttings exiting the borehole will be promptly containerized using DOT-approved drums.

In boreholes where monitoring wells are not installed, boreholes will be properly abandoned according to procedures described in the Field Sampling Plan. In instances where boreholes must be left open and unattended, barriers such as a traffic cones will be placed over and around an open borehole to prevent personnel and/or equipment from falling in.

Noise

Noise can produce potential hazards because it may interfere with normal communication between on-site personnel. It may also startle or distract. Noise can produce physical damage to the ear that may cause pain and temporary or permanent hearing loss.

There are three general classes of noise which are found around groundwater monitoring site operations. Continuous noise is heard when the drill rig is running, intermittent noise can be heard over continuous noise such as when an air compressor is used, and impact-type noise is produced by hammers and driving drill tools.

Hearing loss can be reduced by using hearing protectors, which act as barriers to reduce sound entering the ear. Protectors include disposable or reusable plugs and ear muffs attached to hard hats. Manufacturers supply Noise Reduction Ratings based on a system which indicates how much noise reduction is attained with each type of protector.

OSHA has established guidelines to prevent occupational hearing loss. Whenever employee exposure equals or exceeds an average of 85 dB per 8-hour day, TEC will implement a hearing conservation program in accordance with OSHA regulations (29 CFR 1910.95).

Chemical Hazards

Chemical hazards may be encountered during advancement of soil borings. These hazards may exist as organic vapors in the borehole annulus and as soil cuttings and drilling fluids exiting the borehole. To minimize contact with potentially contaminated media, the breathing zone of on-site workers in the vicinity of the drill rig will be monitored with a PID. Ambient air monitoring will be performed on a hourly basis; more often if drilling conditions warrant. All PID readings will be recorded in a field log book. If PID readings exceed site-specific action levels, PPE may be upgraded to Level C protection.

APPENDIX B

PROCEDURES FOR MONITORING WELL INSTALLATION/DEVELOPMENT

APPENDIX B
PROCEDURES FOR MONITORING WELL INSTALLATION/DEVELOPMENT

The groundwater monitoring wells typically are designed such that the 10-foot-long well screen extends from the base of the soil boring to a depth approximately 5 feet above the encountered groundwater table.

General hazards associated with monitoring well installation and development include use of heavy equipment and chemical contaminants. For a discussion of noise, electrical, and heavy equipment hazards, refer to Appendix A, Procedures for Soil Borings.

Placement of the casing and screen will be initiated by measurement of organic vapors in the borehole and in the breathing zone. If levels exceed site-specific action levels, the level of protection will be upgraded. Well development will proceed by initially measuring organic vapor levels in the borehole annulus with a portable PID after removing the well cap. Measuring ambient air quality in the borehole annulus will allow TEC personnel to make a preliminary assessment of PPE requirements. If PID readings exceed site-specific action levels, TEC field personnel will upgrade PPE to Level C protection (e.g., air purifying respirators). Following ambient air monitoring, TEC field personnel will measure the depth to groundwater and total well depth to calculate the volume of water (gallons) present in one well bore. Subsequently, groundwater will be evacuated from each monitoring well until stabilization criteria are met for selected water quality parameters (pH, electrical conductance, groundwater temperature, and turbidity). Air monitoring data, volume of water removed, and stabilization parameters will be recorded on field data sheets.

During monitoring well installation and development, on-site personnel will be exposed to potentially contaminated groundwater. To minimize exposure to contaminants, field personnel will routinely use Modified Level D protective clothing. Of particular importance is the donning of safety glasses and gloves during well development to minimize contact with groundwater that may occur due to splashing and/or accidental spillage.

Well development fluids and soil cuttings generated by monitoring well installation shall be properly containerized using sealed, DOT-approved steel 55-gallon capacity drums. These drums will be stored at each monitoring well location. Each container shall be properly labeled with site identification, sampling point, depth, matrix, constituents of concern, and other pertinent information for handling.

APPENDIX C

PROCEDURES FOR MONITORING WELL PURGING/SAMPLING

APPENDIX C
PROCEDURES FOR MONITORING WELL PURGING/SAMPLING

Monitoring wells will be installed on the site, at the perimeter, and at off-site locations. These wells will be used to determine the extent of contamination. Sampling activities centered around these wells will include:

- well development;
- water level measurements;
- slug/pump testing;
- geophysical logging;
- water sampling for chemical analysis; and
- surveying.

Experience in the field has shown three constants.

- Volatile and semi-volatile fractions or organic contaminants tend to accumulate in the well stems.
- In situations where this accumulation has not been noted, disturbance of the water column (e.g., bouncing the bailer) usually liberates some volatile organics.
- These organics tend to escape the well stem as a slug once the cap is removed from the well head, and subsequently decrease in concentration rapidly over time - usually reaching background concentrations within 30 minutes. In highly contaminated areas, this concentration may not decrease.

Based on the above, the following procedures for initial well opening will be followed at all sites.

- A two-party team will initiate well opening prior to any sampling activity.
- The wells will, whenever possible, be approached from an upwind direction.
- Initial well opening will require a minimum of Level C respiratory protection, i.e., a Willson 6000 APR with a GMC-H cartridge (or other appropriate cartridge based on known site contaminants).
- Wells, especially deep wells constructed of solid unvented casing with threaded caps, will be opened slowly and carefully to avoid a sudden release of gases due to over-pressure.
- Wells will be sniffed or monitored with PID instrumentation. All readings will be recorded in the field log book. Note that if radioactive contaminants are determined to be present, a radiological screen is also necessary.
- If HCN or other chemical species for which Level C does not provide adequate protection are the contaminants of concern, this procedure may have to be conducted using Level B protection.

- If positive results are obtained, the well will be allowed to vent for a period of time (experience has shown that 15-30 minutes is usually sufficient) and sniffed again. Note that this is a guideline only; the actual time may vary.
- If initial readings are of such a magnitude to indicate a potential health hazard from the venting process, the wells will be immediately recapped and locked.
- If background readings are obtained (or if initial positive concentrations have decreased to background levels), work activities can be initiated in Level D respiratory protection. Note that activities that disturb the water column may liberate organics not previously observed. Based on readings, odors, and their consistency over time, Level C or D protection may have to be utilized again. In general, readings should be taken four or five times every hour at a minimum, as specified by the PHSM.
- If instrument readings have not diminished in the allotted time frame, sampling (or other) activities will be conducted using a minimum of Level C protection.
- Standard action levels will be utilized to determine the adequate level of protection (C or D). In the situation where only one chemical contaminant exists (e.g., TCE), the TLV, combined with known contaminant history (e.g., maximum concentration) will guide the decision logic for selecting levels of respiratory protection.
- Based on site-specific conditions (e.g., if the site is secure) all wells can be opened and sniffed sequentially prior to sampling. In this way, the maximum amount of time is provided for venting.

At sites where contaminant history (i.e., disposal methods, types and amounts of contaminants, concentrations present in different media) is known and understood through previous sampling, and this data conclusively shows that organics are not a concern, this requirement can be waived by presenting the rationale/justification to the PHSM.

APPENDIX D

LEVELS OF PROTECTION

APPENDIX D
LEVELS OF PROTECTION

Note: The following Appendix is based on the *Standard Operating Safety Guidelines,* USEPA, Environmental Response Branch, Hazardous Response Support Division, Office of Emergency and Remedial Response, November, 1984.

Introduction

Wear personnel protective equipment when response activities involve known or suspected atmospheric contamination; when vapors, gases, or particulates may be generated by site activities; or when direct contact with skin-affecting substances may occur. Full face-piece respirators protect the lungs, gastrointestinal tract, and eyes against airborne toxins. Chemical-resistant clothing protects the skin from contact with skin-destructive and absorbable chemicals. Good personal hygiene limits or prevents ingestion of material.

Equipment to protect the body against contact with known or anticipated toxic chemicals has been divided into four categories according to the degree of protection afforded.

Level A: Should be worn when the highest level of respiratory, skin, and eye protection is needed.

Level B: Should be worn when the highest level of respiratory protection is needed, but a lesser level of skin protection.

Level C: Should be worn when the criteria for using air-purifying respirators is met, and a lesser level of skin protection is needed.

Level D: Should be worn only as a work uniform and not on any site with respiratory or skin hazards. It provides minimal protection against chemical hazards.

NOTE: Modifications of these levels are permitted, and routinely employed during site work activities to maximize efficiency. For example, Level C respiratory protection and Level D skin protection may be required for a given task.

The Level of Protection selected should be based on:

- Type and measured concentration of the chemical substance in the ambient atmosphere and its toxicity.
- Potential for exposure to substances in air, splashes of liquids, or other direct contact with material due to work being done.
- Knowledge of chemicals disposed along with properties such as toxicity, route of exposure, etc.

In situations where the type of chemical, concentration, and possibilities of contact are not known, the appropriate Level of Protection must be selected based on professional experience and judgment until the hazards can be better identified.

Wearing personnel protective equipment (PPE) reduces the potential for contact with toxic substances, ensuring the health and safety of responders. In addition, safe work practices requires decontamination, site entry protocols, and other safety procedures. Together, PPE and safe work practices provide an integrated approach for reducing potential harm to workers.

There are four basic levels of protection: A, B, C, and D as described below.

The equipment listed is considered generic. The actual selection of equipment is based on need.

Level A Protection

NOTE: Although Level A site work tasks may be within the scope of work on TEC projects, Level A activities are generally not performed as part of TEC work tasks. This section is included primarily for informational purposes.

<u>Personnel Protective Equipment (PPE)</u>

Level A Personnel Protective Equipment includes:

- Supplied-air respirator approved by the Mine Safety and Health Administration (MSHA) and National Institute for Occupational Safety and Health (NIOSH). Respirators may be positive pressure-demand, self-contained breathing apparatus (SCBA) or positive pressure-demand, airline respirator with escape bottle for Immediately Dangerous to Life and Health (IDLH) or potential for IDLH atmosphere.
- Fully encapsulating chemical-resistant suit.
- Coveralls.
- Long cotton underwear.
- Gloves (inner), chemical-resistant.
- Boots, chemical-resistant, steel toe and shank (depending on suit construction, worn over or under suit boot).
- Hard hat (under suit).
- Disposable gloves and boot covers (Worn over fully encapsulating suit).
- Cooling unit.
- 2-Way radio communications (inherently safe).

<u>Criteria For Selection</u>

Level A Protection is needed if any of these criteria are met:

- The chemical substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on: (1) measured (or potential for) a high concentration of atmospheric vapors, gases, or particulates; or (2) a high probability that site operations and work functions will involve splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials highly toxic to the skin.

- Substances with a high degree of hazard to the skin are known, or suspected to be present, and skin contact is possible.
- Operations are conducted in confined, poorly ventilated areas and the absence of substances requiring Level A protection has not been established.
- Direct readings on field Flame Ionization Detectors (FID) or Photo Ionizing Detectors (PID) and similar instruments indicate high levels of unidentified vapors and gases in the air, i.e., greater than 500 in an unknown environment.

Guidance On Selection

Fully encapsulating suits are primarily designed to provide a gas or vapor tight barrier between the wearer and atmospheric contaminants; therefore, Level A is generally worn when high concentrations of airborne substances are known, or thought to be, present and these substances could severely affect the skin. Because Level A requires the use of a self-contained breathing apparatus, the eyes and respiratory system are also protected.

Until air surveillance data are available to assist in the selection of the appropriate Level of Protection, the use of Level A may have to be based on indirect evidence that either through atmospheric contact, or through some other mechanism, severe skin-affecting substances exist.

Conditions that may require Level A protection include:

- *Confined spaces*: Enclosed, confined, or poorly ventilated areas are conducive to build up of toxic vapors, gases, or particulates. Confined space entry does not automatically warrant wearing Level A protection, but serves as a clue to carefully consider its use.
- *Suspected/known highly toxic substances*: Various substances that are highly toxic through skin absorption (for example, fuming corrosives, cyanide compounds, concentrated pesticides, DOT Poison "A" materials, suspected carcinogens, and infectious substances) may be known or suspected to be present. Field instruments may not be available to detect or quantify air concentrations of these materials. Until these substances are identified and concentrations measured, maximum protection may be necessary.
- *Visible emissions*: Visible air emissions from leaking containers such as railroad/vehicular tank cars, as well as smoke from chemical fires and others, indicate high potential for concentrations of substances that could be extreme respiratory or skin hazards.
- *Initial entries*: Initial entries are generally walk-throughs in which instruments and visual observations are used to make a preliminary evaluation of the hazards. In initial site entries, Level A should be worn when: (1) there is a probability for exposure to high concentrations of vapors, gases, or particulates; or (2) substances are known, or suspected to be, extremely toxic directly to the skin or by being absorbed.

Levels of Protection for subsequent operations are based not only on data obtained from the initial monitoring, but also on the probability of contamination and ease of decontamination.

Examples of situations where Level A has been worn are:

- Excavating of soil to sample buried drums suspected of containing high concentrations of dioxin.
- Entering a cloud of chlorine to repair a valve broken in a railroad accident.
- Handling and moving drums known to contain oleum.
- Responding to accidents involving cyanide, arsenic, and undiluted pesticides.

The fully encapsulating suit provides the highest degree of protection to skin, eyes, and respiratory system if the suit material resists chemicals during the time the suit is worn. While Level A provides maximum protection, all suit material may be rapidly permeated and degraded by certain chemicals from extremely high air concentrations, splashes, or immersion of boots or gloves in concentrated liquids or sludges. These limitations should be recognized when specifying the type of fully encapsulating suit. Whenever possible, the suit material should be matched with the substance it is used to protect against.

Level B Protection

<u>Personnel Protective Equipment</u>

Level B Personnel Protective Equipment includes:

- Supplied-air respirator (MSHA/NIOSH approved). Respirators may be positive pressure-demand, self-contained breathing apparatus (SCBA) or positive pressure-demand, airline respirator (with escape bottle for IDLH or potential for IDLH atmosphere).
- Chemical-resistant clothing (overalls and long-sleeved jacket; hooded, one or two-piece chemical-splash suit; disposable chemical-resistant, one-piece suits).
- Long cotton underwear.
- Coveralls.
- Gloves (outer), chemical-resistant.
- Gloves (inner), chemical-resistant.
- Boots (outer), chemical-resistant, steel toe and shank.
- Boot covers (outer), chemical-resistant (disposable).
- Hard hat (face shield).
- 2-Way radio communications (intrinsically safe).

Criteria For Selection

Level B Protection is needed if any one of these criteria is met:

- The type and atmospheric concentration of toxic substances has been identified and requires a high level of respiratory protection, but less skin protection than Level A. These would be atmospheres: (1) with IDLH concentrations, but substance or concentration in the air does not represent a severe skin hazard, or (2) that do not meet the selection criteria permitting the use of air-purifying respirators.
- The atmosphere contains less than 19.5% oxygen.
- It is highly unlikely that the work being done will generate high concentrations of vapors. gases or particulates; or splashes of material that will affect the skin of personnel wearing Level B protection.
- Atmospheric concentrations of unidentified vapors or gases are indicated by direct readings on instruments such as the FID or PID or similar instruments, but vapors and gases are not suspected of containing high levels of chemicals toxic to the skin.

Guidance On Selection

Level B does not afford the maximum skin protection as does a fully encapsulating suit, because Level B chemical-resistant clothing is not considered gas, vapor, or particulate tight; however, a good quality, hooded, chemical-resistant, one-piece garment, with taped wrists, ankles, and hood does provides a reasonable degree of protection against splashes and to lower concentrations in air. At most hazardous waste sites, ambient atmospheric gas or vapor levels have not approached concentrations sufficiently high to warrant Level A protection. In all but a few circumstances (where highly toxic materials are suspected) Level B should provide the protection needed for initial entry. Subsequent operations at a site require a re-evaluation of Level B protection based on the probability of being splashed by chemicals, their effect on the skin, the presence of hard-to-detect air contaminants, or the generation of highly toxic gases, vapors, or particulates, due to the work being done.

The chemical-resistant clothing required in Level B is available in a wide variety of styles, materials, construction detail, and permeability. One or two-piece garments are available with or without hoods. Disposal suits with a variety of fabrics and design characteristics are also available. Taping joints between the gloves, boots, and suit, and between hood and respirator reduces the possibility for splash and vapor or gas penetration. These factors and other selection criteria all affect the degree of protection afforded; therefore, a specialist should select the most effective chemical-resistant clothing based on the known or anticipated hazards and job function.

Level B equipment provides a high level of protection to the respiratory tract. Generally, if a self-contained breathing apparatus is required for respiratory protection, selecting chemical-resistant clothing (Level B) rather than a fully encapsulating suit (Level A) is based on needing less protection against known or anticipated substances affecting the skin. Level B skin protection is selected by:

- Comparing the concentrations of known or identified substances in air with skin toxicity data.
- Determining the presence of substances that are destructive to or readily absorbed through the skin by liquid splashes, unexpected high levels of gases, vapor, or particulates, or other means of direct contact.
- Assessing the effect of the substance (at its measured air concentrations or potential for splashing) on the small areas left unprotected by chemical-resistant clothing. A hooded garment taped to the mask, and boots and gloves taped to the suit further reduces area of exposure.

For initial site entry and reconnaissance at an open site, approaching whenever possible from upwind, Level B protection (with good quality, hooded, chemical-resistant clothing) should protect response personnel, providing the conditions described in selecting Level A are known or judged to be absent.

Level C Protection

Personnel Protective Equipment

Level C Personnel Protective Equipment includes:

- Air-purifying respirator, full-face, cartridge-equipped (MSHA/NIOSH approved).
- Chemical-resistant clothing (coveralls; hooded, one-piece or two-piece chemical splash suit; chemical-resistant hood and apron; disposable chemical-resistant coveralls).
- Coveralls.
- Long cotton underwear.
- Gloves (outer), chemical-resistant.
- Gloves (inner), chemical-resistant.
- Boots (outer), chemical-resistant, steel toe and shank.
- Boot covers (outer), chemical-resistant (disposable).
- Hard hat (face shield).
- Escape mask.
- 2-Way radio communications (intrinsically safe).

Criteria For Selection

Level C Protection is needed if all of these criteria are met:

- Oxygen concentrations are greater 19.5 percent by volume.
- Measured air concentrations of identified substances will be reduced by the respirator below the substance's TLV or PEL and the concentration is within the service limit of the cartridge.

- Atmospheric contaminant concentrations do not exceed IDLH levels.
- Atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect any body area left unprotected by chemical-resistant clothing.
- Job functions do not require a self-contained breathing apparatus.
- Continuous direct readings are a few parts per million (i.e., up to 5 ppm) above background in an unknown environment on instruments such as the FID or PID.

Guidance On Selection

Level C protection is distinguished from Level B by the equipment used to protect the respiratory system, assuming the same type of chemical-resistant clothing is used. The main selection criterion for Level C is that conditions permit wearing air-purifying respirators.

The air-purifying device is generally a full-face respirator (MSHA/NIOSH approved) equipped with the appropriate cartridge. Cartridges must be able to remove the substances encountered. Quarter- or half-masks should be used only with the approval of the HSM. In addition, a full-face, air-purifying mask can be used only if:

- Substance has adequate warning properties,
- Individual passes a qualitative fit-test for the mask, and
- Appropriate cartridge is used, and its service limit concentration is not exceeded.

An air surveillance program is part of all response operations when atmospheric contamination is known or suspected. It is particularly important that the air be thoroughly monitored when personnel are wearing air-purifying respirators. Periodic surveillance using direct-reading instruments and air sampling is needed to detect any changes in air quality necessitating a higher level of respiratory protection.

Level C protection with a full-face, air-purifying respirator should be worn routinely in an atmosphere only after the type of air contaminant is identified, concentrations measured, and the criteria for wearing air-purifying respirator met. To permit flexibility in prescribing a Level of Protection at certain environmental incidents, a specialist could consider using air-purifying respirators in unidentified vapor/gas concentrations of a few parts per million above background as indicated by a needle deflection on the Flame Ionizing Detector (FID) or Photo Ionizing Detector (PID). However a needle deflection of a few parts per million above background should not be the sole criterion for selecting Level C. Because the individual components may never be completely identified, a decision on continuously wearing Level C must be made after assessing all safety considerations, including:

- The presence of (or potential for) organic or inorganic vapor/gases against which a cartridge is ineffective or has a short service life.
- The known (or suspected) presence in air of substances with low TLVs or IDLH levels.
- The presence of particulates in air.

- The errors associated with both the instruments and monitoring procedures.
- The presence of (or potential for) substances in air which do not elicit a response on the instrument used.
- The potential for higher concentrations in the ambient atmosphere or in the air adjacent to specific site operations.

The continuous use of air-purifying respirators (Level C) must be based on the identification of the substances contributing to the total vapor or gas concentration and the application of published criteria for the routine use of air-purifying devices. Unidentified ambient concentrations of organic vapors or gases in air approaching or exceeding a few ppm (i.e., up to 5 ppm in an unknown environment) above background require, as a minimum, Level B protection.

Level D Protection

Personnel Protective Equipment

Level D Personnel Protective Equipment includes:

- Coveralls.
- Gloves.
- Boots/shoes, leather or chemical-resistant, steel toe and shank.
- Safety glasses.
- Hard hat.

Criteria For Selection

Level D Protection is warranted if any of these criteria are met:

- No contaminants are present, or contaminants are present below levels where there is evidence of adverse health effects, such as below the TLV or PEL.
- Work functions preclude splashes, immersion, or potential for unexpected inhalation of any chemicals.

Level D protection is primarily a work uniform. It can be worn only in areas where there is no possibility of contact with contamination.

Protection in Unknown Environments

For all incident responses, selecting the appropriate personnel protection equipment is one of the first steps in reducing health effects from toxic substances. Until the toxic hazards at an environmental incident can be identified, and personnel safety measures commensurate with the hazards instituted, preliminary measures will have to be based on experience, judgment, and professional knowledge. One of the first concerns in evaluating an unknown situation is atmospheric hazards. Toxic concentrations (or potential concentrations) of vapors, gases, and particulates; low oxygen content explosive potential and, to a lesser degree, the possibility of radiation exposure all represent immediate atmospheric hazards. In addition to making air measurements to determine these hazards, visual observation and review of existing data can help determine the potential risks from other materials.

Once immediate hazards, other than toxic substances have been eliminated, the initial on-site survey and reconnaissance, which may consist of more than one entry, continues. The purpose of the on-site survey is to further characterize toxic hazards and, based on these findings, refine preliminary safety requirements. As data are obtained from the initial survey, the Level of Protection and other safety procedures are adjusted. Initial data also provide information on which to base further monitoring and sampling. No one method can determine a Level of Protection in all unknown environments. Each situation must be examined individually.

Additional Considerations For Selecting Levels Of Protection

Other factors which should be considered in selecting the appropriate Level of Protection are described below.

Heat and Physical Stress

The use of protective clothing and respirators increases physical stress, in particular heat stress, on the wearer. Chemical protective clothing greatly reduces body ventilation and diminishes the body's ability to regulate its temperature. Even in moderate ambient temperatures, the diminished capacity of the body to dissipate heat can result in one or more heat related problems.

All chemical protective garments can cause heat stress. Somewhat less stress is associated with Level B or C Protection when the specified clothing does not require the use of a hood (tightly fitted against the respirator face piece) and taped gloves, boots, and suit, because more body ventilation and evaporation can occur. As more body area is covered, the probability of heat stress increases. Whenever any chemical-protective clothing is worn, a heat stress recovery monitoring program must occur.

Wearing protective equipment also increases the risk of accidents. It is heavy, cumbersome, decreases dexterity, agility, interferes with vision, and is fatiguing to wear. These factors all increase physical stress and the potential of accidents. In particular, the necessity for selecting Level A protection should be balanced against the increased probability of physical stress and accidents. Level B and C protection somewhat reduces accident probability because the equipment is lighter, less cumbersome, and vision problems are less serious.

Air Surveillance

A program must be established for routine, periodic air surveillance. Without an air surveillance program, any changes could go undetected and jeopardize response personnel. Surveillance can be accomplished with various types of air pumps and filtering devices followed by analysis of the filtering media; portable real-time monitoring instruments located strategically on site; personal dosimeters; and periodic walk-throughs by personnel carrying direct-reading instruments.

Decision Logic for Selecting Protective Clothing

No adequate criteria, similar to the respiratory protection decision-logic, are available for selecting protective clothing. A concentration of a known substance in the air approaching a TLV or permissible exposure limit does not automatically warrant a fully encapsulating suit. A hooded, high quality, chemical-resistant suit may provide adequate protection. The selection of Level A over Level B Protection is a judgment that should be made by a qualified individual considering the following factors:

- *The physical form of the potential contaminant.* Airborne substances are more likely for body contact with personnel wearing non-encapsulating suits because they are not gas or vapor tight.
- *Effect of the material on skin.* Highly hazardous substances are easily absorbed through the skin creating systemic effects, or causing severe skin destruction. Skin contact with liquids is generally more hazardous than vapors, gases, and particulates. Less hazardous substances are not easily absorbed through the skin creating systemic effects, or causing severe skin destruction.
- *Concentration of the material.* The higher the concentration, the higher the risk of harm.
- *The potential for contact.* Exposure to the material due to work function and the probability of direct exposure to the small area of skin unprotected by Level B or C chemical-resistant clothing is an important consideration.

Atmospheric Conditions

Atmospheric conditions such as temperature, wind direction, wind velocity, and barometric pressure determine the behavior of contaminants in air or the potential for volatile material getting into the air. These parameters should be considered in determining the need for and the appropriate Level of Protection required.

Work in Exclusion Zone

For operations in the Exclusion Zone (area of potential contamination), different Levels of Protection may be selected, and various types of chemical-resistant clothing worn. This selection would be based not only on measured air concentrations, but also on the job function, reason for being in the area, the potential for skin contact or inhalation of the materials present, and ability to decontaminate the protective equipment used.

Escape Masks

The use of escape masks is an option in Level C protection. A specialist should determine their use on a case-by-case basis. Escape masks could also be strategically located on site in areas that have higher possibilities for harmful exposure.

Vapor or Gas Concentrations as Indicated by Direct-Reading Instruments

Instruments such as the FID and PID can be used to detect the presence of many organic vapors or gases either as single compounds or mixtures. Dial readings are frequently referred to, especially with unidentified substances, as total vapor and gas concentrations (in ppm). More correctly they are deflections of the needle on the dial indicating an instrument response and do not directly relate to total concentration in the air without using response factors. **In addition, when setting action levels based on total vapor readings, the instrument's sensitivity or span must be specified.** As a guide to selecting Level of Protection in an unknown environment, based on dial readings only, the following values could be used. They should not be the sole criteria for selecting Levels of Protection. For example, if the substances are known, the TLV, or PEL, is used (see Section 12).

Dial Reading	*Level of Protection*
Up to 5 ppm above background	C
5 ppm above background to 500 ppm above background	B
500 ppm above background to 1000 ppm above background	A

Vapor or gas concentration, as indicated by the readout on instruments such as the FIDs or PIDs are a useful adjunct to professional judgment in selecting the Level of Protection to be worn in an unknown environment. It should not be the single selection criterion, but should be considered with all other available information. Total vapor or gas concentration as selection criteria for Levels of Protection should only by used by qualified, experienced persons.

Upgrading/Downgrading Level of Protection

The level of protection shall be upgraded or downgraded upon direction of the SHSM, or HSM.

Reasons to upgrade level of protection include:

- Odors or direct readings on a PID, FID, or other instrument that indicates the presence of increased levels of chemicals.
- Request of individual performing task.
- Occurrence, or likely occurrence, of gas or vapor emission.
- Change in task that will increase contact or potential contact with hazardous materials.
- Increased dermal-respiratory hazards.
- Presence of chemical contaminants above an established action level as indicated by direct reading instruments or odors.

Reasons to downgrade level of protection include:

- New information indicating that the situation is less hazardous than was originally thought.
- Change in conditions that decreases the hazard.
- Change in task that will reduce contact with hazardous materials.

APPENDIX E

PHYSICAL SAFETY HAZARD PROCEDURES

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PHYSICAL SAFETY HAZARD PROCEDURES

Possible physical hazards associated with field activities at the site may include any of the hazards discussed below. The controls specified shall be implemented during site operations. For additional information, refer to the TEC Health and Safety Policy Manual for Hazardous Waste Projects.

Noise

The main sources of noise for this project are drill rigs. Hearing protection must be worn in areas where noise levels are at the permissible exposure limit (PEL) of 85 dBA or greater. Hearing protection is required when, at 3 feet apart in normal conversation, voices must be raised to be heard. A Type II sound level meter should be used to measure site noise to verify sound levels and determine the need for hearing protection. Hearing protection should be specified by the PHSM or SHSM based on measured levels at the site.

Precariously Positioned Objects

Field personnel shall become familiar with the general area and the potential physical hazards associated with debris or objects (e.g., drums, boards) that may be piled or scattered around the sites. If objects are stacked in an unsafe manner, the PHSM shall notify the client site contact. Field activities shall not begin until Base personnel remove or safely restack the objects.

Walking and Working in Open Terrain

Field personnel shall become familiar with the general terrain of the site and potential physical hazards (evaporation ponds, uneven terrain, etc.) that would be associated with accidental slips, trips, and/or falls.

Lifting

Field personnel should use their own judgment in determining loads that they can safely lift. When possible, loads should be lifted with two hands, without trunk rotation, and using leg muscles for elevation, not back muscles Loads should also be lifted so that the center of mass is stable during the initiation and duration of the lift. Floor surfaces should be in good condition (e.g., clear of obstacles, level, dry). Workers and supervisors should also increase rest duration and frequency if necessary to reduce injury potential.

Repetitive lifting increases potential of injury. Ambient temperature should also be considered if lifting requires repetitive motion. *The Applications Manual For The Revised Lifting Equation* (NIOSH, 1994) contains more detailed information regarding repetitive lifting and required recovery periods. If frequent repetitive lifting is anticipated, the NIOSH manual is recommended to estimate the hazard to workers in order to reduce potential injuries.

As mentioned earlier, field personnel should use their own judgment when lifting heavy objects as dexterity and muscle conditioning may vary greatly by individual. The following recommendations should be considered when lifting a heavy load:

- bring the load closer to the body;
- remove any horizontal barriers;
- reduce the size of the load;
- avoid lifts near the floor;
- if loads near the floor cannot be avoided, the load should fit easily between the legs;
- raise/lower the origin/destination of the lift;
- reduce trunk rotation by rotating the feet;
- reduce the lifting frequency and duration;
- provide longer recovery periods;
- provide new containers with adequate handles; and
- eliminate the need for lifting by redesigning or modifying the container characteristics.

Tagging of Defective Tools, Materials, or Equipment

Defective tools, materials, or equipment that could impact personnel safety or the environment shall not be used. When a defective tool, material, or piece of equipment is found, the PHSM shall take it out of service immediately by tagging, destroying, or removing it from the project. Danger tags shall be dated, sequentially numbered, and signed by the supervisor. A defective equipment log shall be maintained.

Housekeeping

Poor housekeeping is a sign of a poorly managed project and is the root of many safety problems. All material, scrap, tools, toolboxes, and other equipment shall be stored in a neat and orderly fashion. Trash and scrap shall be removed from the work area on a regular basis (i.e., at least daily before the end of each work shift) and shall never be allowed to accumulate, especially in walkways, under stairs, at the bases and landings of stairs and ladders, and near flammable substances.

Housekeeping will receive a major emphasis during daily and weekly inspections. If the housekeeping has become a problem, the PHSM or SHSM reserves the right to stop work and require a cleanup before work resumes.

Illumination

Adequate lighting is extremely important for the safe execution of work. The minimum illumination intensity shall be 5 foot-candles in all active work areas and accessways. In specified areas outlined in the OSHA standard, 29 CFR 1926.56, the required intensity ranges as high as 20 foot-candles. Lighting intensity will be surveyed during job site inspections.

Slip, Trip, and Fall Hazards

Falls as a result of slipping or tripping are the most common form of injury on construction sites. These injuries are a result of poor housekeeping, lack of attention to detail, or carelessness.

Slipping hazards such as grease, oil, water, ice, snow, or other liquids shall be cleaned up or eliminated on walkways, ladders, scaffolds, or other accessways or working areas. If slipping hazards cannot be eliminated completely, the area shall be barricaded and posted with applicable hazard postings.

The job site, especially roadways, accessways, aisles, stairways, scaffolds, and ladders shall be kept clean and clear of hoses, extension cords, welding leads, and other obstructions that may cause tripping or other accident hazards. If tripping hazards cannot be eliminated completely, the area shall be barricaded and posted with applicable hazard postings.

Fire Protection and Prevention

All necessary and appropriate precautions to prevent fires will be taken. Sufficient water and fire fighting equipment shall be available at all times to control fires as specified below. All heavy equipment must be equipped with 5-pound dry chemical fire extinguishers rated ABC. A 10-pound dry chemical fire extinguisher rated ABC must be located in all trailers per The National Fire Protection Association (NFPA) 10 Standard. A 20-pound fire extinguisher rated ABC must be provided within 50 feet, but no closer than 25 feet, to all fueling operations and flammable storage areas.

All fire extinguishers shall be mounted on walls or stands with a red background. Fire extinguishers shall not be mounted with the top less than 3 feet or greater than 5 feet above the floor. Access routes to fire extinguishers shall be kept clear at all times. All fire extinguishers shall be inspected monthly, annually, and every 6 years in accordance with the NFPA 10 Standard on fire extinguisher inspections.

Open burning of trash and debris shall not be permitted. If there is a danger of accidental fire, e.g., during cutting or welding operations, a person shall be designated as fire watch and shall be dedicated solely to this effort during that operation and shall continue this duty for 30 minutes after the operation is completed.

Internal combustion engines will not be permitted to operate in buildings unless authorized. Engines shall be turned off while refueling. Storage of flammable fuels will be carefully monitored. All fuel storage areas and storage tanks must have written approval by the PHSM. Marking and labeling of fuel tanks shall meet the requirements of OSHA 29 CFR 1926.59. All heating devices and their locations must be inspected by the PHSM before use. Fueling areas and tanks shall comply with all applicable NFPA and OSHA requirements.

Flammable or combustible liquid storage shall comply with NFPA 30 and OSHA 1926.152. All fuel cans, such as 5-gallon gas cans, shall be free of deformities and constructed of metal, with self-closing lids and flame arresters. Fuel cans shall be labeled with their contents. All equipment shall be fueled through funnels or spouts to prevent spills.

Material Handling and Storage

All new material shall be stored on dunnage. All material shall be stored and secured as necessary to prevent blowing, falling, sliding, or collapsing. Debris and scrap material need not be stored on dunnage if the material will not be moved with rigging and can be maintained in a stable manner. TEC and all subcontractors shall ensure that material is stored properly to prevent scattering or lost equipment.

Walkways and aisles shall be kept clear at all times, and laydown areas shall be neat and orderly. Material shall be stored on level ground, and the boundaries of laydown areas shall be identified. Material shall not be stored within 6 feet of hoistways or floor openings, or within 10 feet of roof edges. Poles, pipe, and other stock that may roll shall be wedged to prevent spreading and rolling.

Nails shall be removed from lumber that is to be reused. Nails in scrap lumber that will not be rehandled shall be bent back.

No material, tools, or equipment shall be leaned against other objects or walls unless they are secured from movement. Employees moving material by hand shall use proper lifting techniques and gloves. Safe working load limits shall be labeled on all temporary elevated floors or platforms and these limits shall not be exceeded.

Tools

All tools shall be kept in good condition and properly stored. Tools shall not be altered, and they shall be used only for their intended purposes. Guards shall not be removed from tools, and all nip points, open drums, and fly wheels shall be guarded. All tools shall be inspected by the user before use, with special attention to power cords and the condition of teeth. If a power cord has been repaired more than once, the tool shall be tagged defective, and not used until a new power cord is installed. Drawings of job-built jigs and tools shall be submitted to the PHSM. Owner's manuals shall be available upon request, and personnel shall be trained in the safe operation of all tools used.

Power tools shall be equipped with constant pressure switches that will shut the tool off when the switch is released. All power tools and electrical equipment shall be double insulated or be equipped with ground plugs.

All bench-mounted and floor-mounted tools shall be secured. Bench-mounted grinders shall be set up and operated according to 29 CFR 1926.303. Tools equipped with handles shall have the handles installed. Cracked, splintered, or taped wooden handles shall be replaced. Cheater bars will not be permitted. Impact tools shall be free of mushroomed heads and cracks. Workbenches and sawhorses shall be provided when needed.

Torch/Plasma Arc Cutting, Welding, and Open Flame Requirements

At a minimum, fire prevention equipment shall consist of one 10-pound, dry chemical extinguisher rated ABC. A live water line meeting the requirements of OSHA 29 CFR 1926.150 or a water pump extinguisher may be used as a supplement to the dry chemical extinguisher. The work area shall be barricaded and posted; the equipment shall be inspected and exits identified.

An approved permit shall be posted in the work area. Adjoining work areas shall be inspected and workers in the immediate vicinity shall be notified.

Upon completion of the above requirements and the precautionary items addressed in the permit, work may commence. The permit may be issued for more than 1 day; however, a daily safety checklist shall be completed by the subcontractor supervisor.

Upon completion of work activities, the permit and checklist shall be returned to the contractor construction engineer.

Torch/plasma arc cutting or welding on galvanized steel, stainless steel, or nonferrous metals shall not be permitted unless half-face or full-face air purifying respirators with high-efficiency particulate air (HEPA) cartridges or equivalent engineering controls (local exhaust with HEPA filtration) are provided. Full-face respirators with HEPA cartridges shall be required during torch cutting on radiologically contaminated metals and metal with lead or cadmium-bearing coatings.

Torch/plasma arc cutting shall not be used on wood, synthetic materials, rubber-lined pipe and vessels, or on any process piping, tanks, vessels or equipment containing significant radioactive material product residues unless approved by the PHSM.

Any torch/plasma arc-cutting operation that may expose workers to contaminants in excess of the action level, without regard to the use of respirators, shall be controlled with the use of local exhaust ventilation in conjunction with a high-efficiency particulate collection system. If gaseous or vapor exposure limits are exceeded, respirators with appropriate cartridges shall be used.

Compressed gas cylinders shall be secured in an upright position at all times. Burning rigs shall be broken down at the end of each shift. Fuel gas hoses shall be stored in a ventilated area (never in gang boxes). Compressed fuel gas cylinders shall not be taken into confined spaces. All other rigs shall be stored in accordance with OSHA standards. Empty cylinders shall be removed at the end of each shift. Burning rigs shall be equipped with backflow preventers at the torch end of each hose.

If there is the potential for accidental fire during burning or welding operations, a fire watch shall be established and continued until 30 minutes after the work has been completed. When there is possibility of injury during burning or welding operations, overhead burning signs and welding blinds shall be installed. A 10-pound dry chemical fire extinguisher rated ABC must be readily available to any welder or employee operating a burning or welding rig.

Welding leads, including lugs on the welder and lead connections, shall be fully insulated at all times. Damaged leads and dry-rotted fuel hoses shall be removed from service.

The subcontractor shall notify the PHSM if any welding or burning is to be done from a suspended platform. The subcontractor will be required to comply with PHSM requirements during such operations. Requirements may include the use of multiple fire watches, covering flammable/combustible materials below the work platform, or other safety measures.

Electrical

Work on energized circuits will not be permitted at the site.

Ground fault circuit interrupters (GFCIs) will be required at all times. Lighting must be hooked up to a GFCI unless the electrical connections are different from all other electrical hookups and cannot be mistakenly exchanged.

Electrical panels, boxes, etc., with open knockouts through which no service has been installed must be covered. Electrical cords and equipment shall not be hung or tied to steel or hung with wire unless a non-conductive material is used to insulate the cord from the metal. Plastic coated wire shall not be used to hang electrical cords. All lights must be equipped with protective, non-conductive covers, and all light bulbs in light stringers must be shatterproof. Cords that pass through doorways or holes or are exposed to vehicle traffic shall be protected from damage. Flexible electrical cords shall not be spliced or have insulation repaired with tape. Only SO-type cords or equivalent shall be used for light stringers.

All breaker boxes, electrical receptacles, and feed lines shall be labeled to identify the "from" and "to" circuits. All breaker boxes and disconnects shall be provided with unobstructed access 36 inches in front of the unit. All 480-volt lines shall be labeled clearly. When passing over or through walkways, electrical cords shall be strung at least 7 feet above the walking surface. The subcontractor shall comply with codes in the current NFPA and National Electric Codes (NEC).

Ladders

All ladders shall be inspected before use and stored on dunnage or ladder racks. Tools and material shall not be left on top platforms of unattended ladders, and material shall never be stored on ladders. All ladders shall be labeled with legible manufacturer instructions and warning labels. Ladders shall not be painted except for identification marks.

All ladders shall be type 1A and shall be wooden or have fiberglass siderails with metal rungs. The bases and landings of all ladders shall be kept clear of obstacles. Stepladders shall not be used as straight ladders, and extension ladders shall not be separated for use. All ladders shall be equipped with skid-resistant feet. If a ladder is used in a doorway, the doorway must be barricaded. Ladders shall not be used in lieu of elevated work platforms.

Employees shall never carry material when climbing ladders, nor shall tools or equipment be thrown to or from personnel on ladders. Hand-lines shall always be used to hoist material. Personnel shall not climb to the top step or top platform of any ladder. When in use, ladders shall be held or secured by tying off. Personnel working on ladders shall not straddle the ladder or overreach so that the body is no longer between the siderails.

Job-built ladders shall be inspected by a competent person and shall meet the OSHA standard. In addition, all job-built ladders shall have a furring strip attached over the filler block and rung.

Scaffolding

Scaffolding shall be erected and used according to the most stringent interpretation of the applicable safety regulations. Only heavy-duty (75 pounds per square foot [psf]) scaffolds will be permitted. All scaffolding shall be erected and inspected by a competent person. Samples of the Stationary Scaffolding Inspection Checklist and Rolling Tower Inspection Checklist are provided. All scaffolding shall be built as completely as possible. This means all decks must be complete (e.g., if a handrail can be installed, it must be installed, and the scaffold must have ladder access and gates).

If a chain or slide bar is used as a gate, a landing between the ladder and the gate shall be erected so that personnel can leave the ladder safely before unchaining the gate or moving the slide bar. All scaffolds shall be equipped with handrails (if possible), regardless of the height of the scaffold. If personnel are required to work under or pass under a scaffold, the area between the guardrail and toeboard shall be screened with No. 18 gauge 0.5-inch mesh wire or equivalent.

Aluminum scaffold boards shall be used whenever possible. Scaffold boards shall not be notched, nailed, used as bearers, or used on the ground as walkways. All scaffold boards shall be cleated and tied with No. 9 gauge wire to prevent displacement. Scaffold boards shall be placed together tightly with a maximum space of 0.25 inch between the planking and toeboard. Crawling boards and chicken ladders are prohibited.

The subcontractor shall submit to the PHSM a tagging and inspection system for scaffolds and other elevated work platforms. This system shall include the method of determining if scaffolding is under construction or unsafe, requires a safety harness, or is approved for use. It shall also include the date on which the scaffolding was last inspected and the name of the inspector. All scaffolds shall be equipped with legs and base plates and shall be placed on mud sills.

Parts from scaffolds made by different manufacturers shall not be interchanged. Welded frame scaffolding shall not be repaired or altered. Anti-sway bars shall be installed on all rolling scaffolds; only welded frame scaffolds may be used as rolling scaffolds. Personnel shall not ride on rolling scaffolds.

All scaffolds must be plumb and tied off every 15 feet or three times the minimum base dimension, whichever is the most conservative. Scaffolding without handrails shall be placed no more than 4 inches from a wall. Drawings of all two-point suspended scaffolds and needle beam scaffolds shall be submitted to the PHSM before such scaffolding is erected.

All scaffolding higher than 50 feet, as measured from the base plate, shall be designed by a registered professional engineer. Such designs shall be submitted to the PHSM for review and approval.

Power-Driven Staging and Platforms

All equipment discussed in this section must be inspected by the PHSM before initial use and by the subcontractor prior to every use. In addition, a documented inspection by a competent person must be conducted quarterly.

All operators of power-driven staging and platforms shall be trained in their use, and the training records shall be submitted to the PHSM. Owner's manuals and drawings of connection methods for all such equipment shall also be submitted to the PHSM. A copy of the owner's manual shall also be kept on each platform. All power-driven staging and platforms shall be placarded properly, and controls shall be labeled clearly.

Operators shall use a check sheet during pre-operational inspections and shall verify the inspection by signing the sheet. The subcontractor shall keep these check sheets on file. All manufacturer's recommendations for inspections and operation shall be followed. The PHSM will provide a check sheet if requested.

Handrails and complete midrails shall be kept in good repair. Secondary lifelines shall always be used on power staging, and all personnel on power platforms shall be tied off.

Power platforms shall not be used to hoist material nor shall personnel exit platforms except when the platform is on the ground. If welding or cutting operations are performed on a power platform, the loadlines and lifelines shall be protected.

Manbaskets

Manbaskets shall not be used except when the total exposure of performing the task by another method would be more hazardous. The PHSM will inspect manbaskets before initial use, and the subcontractor will inspect them prior to each use. Test lifts and crane requirements will be enforced strictly. Manbasket design shall be approved by the PHSM.

A checklist shall be completed and signed during pre-lift meetings, and safety instructions shall be read by personnel entering the basket as well as by the crane operator. Copies of this checklist may be obtained from the PHSM.

All manbaskets shall be equipped with overhead protection. When cutting or welding is being done from a manbasket, the rigging shall be protected. During welding, a non-conductive link shall be installed on the load line. Only rigging that has never been used for any other purpose shall be used with the manbasket.

Signs, Barricades, Guardrails, Handrails, Covers, Stairs, Decks, and Ramps

All signs shall be colored properly and labeled as prescribed by the OSHA standard. Signs shall be constructed of metal, fiberglass, or plastic and shall be removed promptly when no longer needed.

The types of barricades permitted on the project include rope, tape, and hard barricades. The color of the barricades shall coincide with the OSHA color classifications. If hazard information is not provided on a barricade, signs or tags shall be attached to it at 20-foot intervals. If hazard information is not printed on barricades at doorways, signs or tags shall be attached to the doorways. Rope, tape, chain, and similar barriers used to designate the boundaries of posted radiological areas shall be yellow and magenta. Construction fences are physical barriers and need not be yellow and magenta.

Tape barricades shall be installed at a height of 42 inches and at a distance of 5 feet from the hazard. If a hazard is more than 10 feet high, the barricade shall be 1 foot farther away for each additional 5 feet of hazard height. Hard barricades may be adjacent to hazards unless the hazard is elevated. Hard barricades shall be 42 inches high, include midrails, and be capable of withstanding a 200-pound force in any direction. If work is taking place beneath a barricaded area, hard barricades shall be equipped with toeboards. If the area below is a walkway or passageway, the area between the barricade midrail and toeboard shall be screened or blocked. All areas where there is a potential for falling objects shall be barricaded.

Turnbuckles shall be used when a barricade is constructed of wire rope.

Guardrails shall be erected whenever a walking surface changes elevation by more than 2 feet. Tape barricades may be used for this purpose, but such a barricade must be 5 feet from the change in elevation. All changes in elevation shall be marked with some kind of warning such as yellow and black tape or fluorescent orange paint. Handrails shall have smooth surfaces or be taped to prevent splinters. All wall openings shall be guarded. When a door opens onto a platform, the width of the door shall not reduce the effective width of the platform to less than 20 inches.

Runs and risers on all stairs shall be constructed in accordance with OSHA regulations. Ramps shall have a maximum angle of 7 degrees.

Stairs leading to office and warehouse trailers shall be anchored firmly and equipped with handrails. Risers, including the top and bottom steps, shall be of equal height.

Floor hole covers shall be labeled "WARNING – TEMPORARY HOLE COVER – DO NOT REMOVE OR STORE MATERIAL." Hole covers shall be cleated and constructed of 0.75-inch plywood with supports 18 inches on center or less.

Roofs

Before any maintenance work is done on roofing, a solid working surface shall be provided with all the openings guarded and skylights protected. A tape barricade shall be erected 6 feet from the edge of any unprotected roof edge. Personnel crossing barricades shall wear a full-body harness attached to retractable block lifelines.

Before any demolition work is done on roofing, the subcontractor shall have an engineering survey performed by a registered Professional Engineer.

Rigging

General

All rigger's signal men shall be trained properly and provided with a rigging handbook. Documentation of training shall be provided to the PHSM. All rigging shall be performed in accordance with the *Department of Energy Hoisting and Rigging Program Manual* (Ref. 6), which will be available from the PHSM upon request. Major rigging operations must be planned and supervised by competent personnel to ensure that the best methods and most suitable equipment are employed.

The PHSM shall have the authority to cancel hoisting and rigging operations based on consideration of weather, condition of lifting hardware, electrical line clearances, or any other factor that, in the judgment of the PHSM, may adversely affect the successful conclusion of the lift. All rigging must be protected from flame cutting and electric welding operations and from contact with solvents and chemicals.

Equipment Inspection and Testing

When specially fabricated devices are required for hoisting and rigging operations (e.g., lifting beams, material baskets, and spreader beams), the design and calculations for the device shall be reviewed and approved by the PHSM.

All rigging shall be inspected by a competent person before each use and marked as inspected at least annually. All rigging shall be labeled clearly with its capacity. All rigging shall be stored in a rigging loft or an equivalent area where it will not be exposed to the elements.

Job-built rigging and hoisting equipment shall be tested on site at 125 percent capacity, and such tests shall be observed and documented by the PHSM. In addition, drawings of such rigging showing weld details and load capacities shall be submitted to the PHSM and approved before the rigging is used.

Hoisting and rigging equipment for material handling shall be inspected visually prior to use on each shift, and as necessary during its use to ensure that it is safe. Hoisting and rigging equipment shall be load-tested at least annually by a competent person, who, by training and experience, is capable of recognizing defects and taking the appropriate action to correct or eliminate them. Inspections shall be documented and made available.

Safe Working Loads

Hoisting and rigging equipment shall not be loaded in excess of its recommended safe working load, as prescribed in Tables H-1 through H-20 of OSHA 29 CFR 1926, Subpart H, (1926.251, *Rigging Equipment for Material Handling*). Special hoisting devices, slings, chokers, hooks, clamps, or other lifting accessories shall be marked to indicate the safe working loads and shall be proof-tested prior to initial use to 125 percent of their rated load.

The load weight must be determined before it is rigged. The gross load which is the sum of the weight of the rigging, block, hooks, lifting beam, stowed or erected jibs, headache ball, other elements of rigging or equipment and the load, must be accounted for when determining hoisting equipment. Safe working loads of hoisting equipment apply only to freely suspended loads on plumb hoist lines. If hoist line is not plumb, additional side loads will compromise the stability and introduce stresses which exceed equipment designs. Rapid swinging of loads also adds additional stresses and minimizes stability. The load must always be directly below the boom point or upper load block.

The center of gravity must be below the hook and below the lowest point of attachment to ensure stability. Softeners must be used to protect slings at sharp corners. Sharp bends, pinching, and crushing should be avoided. The eye section of wire rope slings must not be bent around corners.

Alloy Steel Chains

Chains shall not be used for lifting except as part of a chainfall or come-along device.

Wire Ropes

Wire ropes shall be kept in good repair and without deformities. Wire ropes with visual signs of kinking, crushing, unstranding, birdcaging, main strand displacement, core protrusion, loss of rope diameter, unevenness of outer strands, corrosion, heat damage, abrasion, broken wires or strands and cracked, worn, or deformed end attachments should be considered in evaluation of sling replacement. Wire rope shall not be used if in one rope lay there are 10 randomly distributed broken wires or five broken wires in one strand.

Tables H-3 through H-14 of OSHA 29 CFR 1926, Subpart H, (1926.251, *Rigging Equipment for Materials Handling*) shall be used to determine the safe working loads of various sizes and classifications of improved plow steel wire rope and wire rope slings with various types of terminals. For sizes, classifications, and grades not included in these tables, the safe working load recommended by the manufacturer for specific, identifiable products shall be followed, provided that a safety factor of not less than 5 is maintained. Wire rope with protruding ends of strands in splices on slings and bridles shall be covered or blunted. Wire rope application use limitations shall be in accordance with 29 CFR 1926.251(c)(4). When U-bolt wire rope clips are used to form eyes, Table H-20 of OSHA 29 CFR 1926, Subpart H, (1926.251, *Rigging Equipment for Materials Handling*) shall be used to determine the number and spacing of clips. A minimum of three clips shall always be used. More clips may be needed when large-dimension wire is used.

Slings

Synthetic slings shall be maintained carefully. Any synthetic sling with the red warning line exposed is to be removed immediately regardless of the extent of the exposure and the use of the sling.

Slings should not be dragged from beneath loads. Knotted and kinked slings will be considered permanently damaged and shall be removed from the site. When estimating sling capacity using multi-legged slings, only two of the legs shall be considered to carry the full load. All loose pieces of material shall be removed from the load prior to moving. Gloves shall be worn when handling wire rope. Hands shall be kept free from pinch points as slack is taken up. The load shall be controlled at all times. Personnel shall keep body parts out of pinch points. Tag lines shall be used.

Tables H-15 through H-18 of OSHA 29 CFR 1926, Subpart H, (1926.251, *Rigging Equipment for Materials Handling*), shall apply when using natural or synthetic fiber rope slings.

All splices in rope slings shall be made in accordance with fiber rope manufacturer's recommendations and 29 CFR 1926.251(d)(2).

Synthetic webbing (nylon, polyester, and polypropylene) shall be identified by the name of the manufacturer, the rated capacities for the type of hitch, and the type of material.

Synthetic web slings shall be removed from operation immediately if there are signs of acid or caustic burns, melting or charring of any part of the sling surface, snags, punctures, tears or cuts, broken or worn stitches, distortion of fittings, discoloration or rotting, or red warning line showing.

Shackles, Hooks, and Bolts

Table H-19 of OSHA 29 CFR 1926, Subpart H, (1926.251, *Rigging Equipment for Materials Handling*) shall be used to determine the safe working loads of various sizes of shackles.

Only one-eye hooks shall be used, and hooking back to the load line will not be permitted in either mechanical rigging or hand rigging. Only one eye of a sling shall be used in a hook. A shackle shall be used to hold two or more eyes. The pin of the shackle should be placed in the hook with the eyes of chokers bearing on the shank.

Only shouldered eyebolts shall be used, except where it is not possible due to the configuration of the item to which the eyebolt is attached. Unshouldered eyebolts shall not be used when the load is to be lifted at an angle, because they are subjected to bending, and the load they can safely carry is severely reduced. Eyebolts should never be welded. Shouldered eyebolts must be installed with the shoulder at a right angle to the axis of the hole and must contact the working surface to keep bending to a minimum; the loads should be applied to the plane of the eye. The tapped hole for screwed eyebolts shall have a minimum depth of one and one-half times the bolt diameter. The point of a hook must never be inserted in an eyebolt; a shackle must be used instead. A sling must not be reeved through pairs of eyebolts. One single leg should be attached to each eyebolt.

The manufacturer's recommendations shall be followed in determining the safe working loads of the various sizes and types of specific and identifiable hooks. All hooks for which no applicable manufacturer's recommendations are available shall not be used.

Shackles and hooks shall be constructed of forged alloy steel with the identifiable load rating and manufacturer on the shackle or hook. All hooks except for sorting hooks and sliding choker hooks shall be equipped with a safety latch.

Knots

Knots shall not be tied in rigging for any purpose, and all rigging shall be used only for its intended purpose. Rigging used to hoist manbaskets shall be identified as such and not used for any other purpose.

Weather Conditions

No rigging or hoisting operation shall be carried out when weather conditions could cause the operation to be hazardous to personnel or property. The size and shape of loads must be examined to determine if a hazard exists during high winds. Wind loading may not exceed equipment capacity. When wind speeds reach 25 to 30 mph, or when visibility is impaired by darkness, snow, fog, or rain, the operation shall be suspended.

When the temperature is below freezing, caution must be used to ensure that no part of the hoisting equipment is shock loaded, as steel fracture can result. Stress factors that reduce rigging capacity and safe working load must be considered when using slings at angles or when slings are choked.

Motor Vehicles and Heavy Equipment

Drivers and/or operators of vehicles and heavy equipment must have the appropriate state license certifying their qualifications to drive or operate each piece of equipment or vehicle. When state certification is not available for a piece of heavy equipment, the subcontractor shall submit to the PHSM a certificate of operator qualification for each operator, listing each piece of heavy equipment that the operator is qualified to operate.

Drivers shall be responsible for the safety of all passengers and the stability of materials being hauled. Personnel shall not mount or dismount moving vehicles. Personnel shall not ride in the bed of any vehicle. Every passenger in a motor vehicle shall have a safe place to ride. The use of seat belts shall be mandatory when operating or riding in vehicles.

Unattended vehicles and heavy equipment shall not be left running. If the operator is to get out of or off of the equipment, it must be shut down properly.

All blades and buckets shall be lowered when the operator leaves the cab unless physically locked or properly blocked.

Heavy equipment shall be maintained in proper operating condition at all times. All machines shall be equipped with roll-over protective structure (ROPS) cabs. Operators shall be trained in the proper method of working on slopes.

All heavy equipment with ROPS cabs shall be labeled as required by 29 CFR 1926.1000. Seat belts shall be installed and used in all equipment with ROPS attachments except for compactors and rubber-tired skid steer equipment. All heavy equipment shall be equipped with functioning back-up alarm systems that are clearly audible above surrounding noise.

All equipment and tools shall be subject to an inspection, conducted by the PHSM, upon arrival at the site and prior to being placed into service. Operators shall perform daily inspections of machinery and equipment. Records of these inspections shall be made and kept by the subcontractor. These records shall be available to the PHSM upon request. Defective equipment that could endanger personnel or the environment shall be tagged defective, and repaired immediately or removed from service. All machinery shall be subject to inspection by the PHSM. Owners' manuals shall be made readily available upon request.

Oils or other fluids (except water) that leak onto the ground shall be cleaned up by the subcontractor, and the contaminated soil shall be disposed of in accordance with the Environmental Cleanup Plan.

All equipment is designed for a particular function and shall be operated according to the manufacturer's recommendations and within the manufacturer's limitations. For lifting operations with equipment other than cranes, prior written approval must be obtained from the PHSM.

Documenting Task Completion

Upon completion of the excavation, the subcontractor shall prepare as-builts and transmit them along with the completed permit to the construction engineer.

Enforcing Permit Requirements

Failure to obtain a permit, or noncompliance with the conditions required by the approved permit, may result in an operational suspension of the activity until an approved permit is issued and/or a CAS-21 Safety Violation Notice is completed.

Traffic Control

The subcontractor shall be responsible for orderly traffic control on the job site. All traffic control measures on public roadways shall be in accordance with Transportation Department regulations for use of flagmen, construction barriers, and appropriate distance requirements. The subcontractor shall provide traffic signs and/or signalmen where and when necessary to protect personnel and/or the general public.

APPENDIX F

HEAT AND COLD STRESS SYMPTOMS AND TREATMENT

APPENDIX F
HEAT AND COLD STRESS SYMPTOMS AND TREATMENT

Heat Stress

If the body's physiological processes fail to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur ranging from mild (such as fatigue, irritability, anxiety; and, decreased concentration, dexterity, or movement) to death. Because heat stress is one of the most common and potentially serious illnesses at hazardous waste sites, regular monitoring and other preventative measures are vital.

Heat stroke is an acute and dangerous reaction to heat stress caused by a failure of heat regulating mechanisms of the body—the individual's temperature control system that causes sweating stops working correctly. Body temperature rises so high that brain damage and death will result if the person is not cooled quickly.

- **Symptoms:** Red, hot, dry skin; absence of perspiration (although the person may have been sweating earlier); nausea; dizziness; confusion; extremely high body temperature, rapid respiratory and pulse rate; unconsciousness or coma.
- **Treatment:** Cool the victim quickly. If the body temperature is not brought down fast, permanent brain damage or death will result. Soak victim in cool but not cold water; if the water is too cold, shock may be induced. Sponge the body with cool water, or pour water on the body to reduce the temperature to a safe level (102 °F). Observe the victim and obtain medical help. Do not give coffee, tea or alcoholic beverages.

Heat exhaustion is a state of very definite weakness or exhaustion caused by the loss of fluids from the body. This condition is much less dangerous than heat stroke, but it nonetheless must be treated.

- **Symptoms:** Pale, clammy, moist skin, profuse perspiration and extreme weakness. Body temperature is normal, pulse is weak and rapid, breathing is shallow. The person may have a headache, may vomit, and may be dizzy.
- **Treatment:** Remove the person to a cool, air-conditioned place, loosen clothing, place in a head-low position, and provide bed rest. Monitor for shock. Consult physician, especially in severe cases. The normal thirst mechanism is not sensitive enough to ensure body fluid replacement. Have patient drink 1-2 cups of water immediately, and every 20-minutes thereafter, until symptoms subside. Total water consumption should be about 1-2 gallons per day.

Heat cramps are caused by perspiration that is not balanced by adequate fluid intake. They are often the first sign of a condition that can lead to heat stroke.

- **Symptoms:** Acute painful spasms of voluntary muscles, (e.g., abdomen and extremities).
- **Treatment:** Remove victim to a cool area and loosen clothing. Have patient drink 1-2 cups of water or, if available, electrolyte replacements (Gatorade, Crystal Light, or Squincher) immediately, and every 20 minutes thereafter, until symptoms subside. Apply direct pressure to affected areas to help ease

cramping. Total water consumption should be 1-2 gallons per day. Consult with physician.

Heat rash is caused by continuous exposure to heat and humid air, and aggravated by chafing clothes. The condition decreases the body's ability to tolerate heat.

- **Symptoms**: Mild red rash, especially in areas of the body in contact with protective gear.
- **Treatment**: Decrease amount of time in protective gear. After decontamination, wash skin and allow to dry thoroughly. Apply powder to help absorb moisture and decrease chafing, unless the skin is broken.

For strenuous field activities that are part of on-going site work activities in hot weather, the following procedures shall be used to monitor the body's physiological response to heat, and to manage the work cycle.

These procedures are to be instituted when the temperature exceeds 70 °F:

- The site health and safety manager or field manager will monitor and control heat stress;
- A work/rest schedule, developed in coordination with subcontractor supervisors, will be implemented dependent on work levels, PPE, and climatic conditions (general guidelines for heavy work at high temperatures in protective clothing include rest breaks in the shade at least 10 minutes out of every hour);
- Plenty of liquids for fluid replacement will be available;
- The site health and safety manager or field manager will monitor workers who are using protective clothing at elevated temperatures by closely observing site workers and measuring heart rate if any symptoms of heat stress are observed; and
- If heart rates exceed 110 beats per minute during or at the beginning of rest periods, the next work period will be shortened by 10 minutes.

Cold Stress

People working outdoors in low temperatures, especially at or below freezing, are subject to cold stress. Exposure to extreme cold for a short time causes severe injury to the surface of the body, or results in profound generalized cooling, causing death. Areas of the body which have high surface area-to-volume ratio such as fingers, toes, and ears, are the most susceptible.

Protective clothing, generally, does not afford protection against cold stress; in many instances, it increases susceptibility.

Two factors influence the development of a cold injury: ambient temperature and the velocity of the wind. Wind chill is used to describe the chilling effect of moving air in combination with low temperature. As a general rule, the greatest incremental increase in wind chill occurs when a wind of 5 mph increases to 10 mph. Additionally, water conducts heat 240 times faster than air. Thus, the body cools suddenly when chemical protective equipment is removed, if the clothing underneath is perspiration soaked.

Chillblains or Frost Nip

- **Symptoms:** Frost nip or incipient frostbite which is characterized by sudden blanching or whitening of skin. Red, lumpy skin; hot to touch; very itchy.
- **Treatment:** After decontamination, treat the victim by carefully removing wet clothing if not frozen to skin. Immerse affected area in warm water, but do not rub. Do not scratch the area. When color begins to return to normal and itching subsides, remove from water bath and pat dry. In future exposure, watch these areas for frostbite. Report the condition to the site health and safety coordinator.

Frostbite

Local injury resulting from cold is included in the generic term frostbite. Frostbite of the extremities can be categorized into:

- Superficial frostbite which is characterized by skin with a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.
- Deep frostbite which is characterized by tissues that are cold, pale, and solid.

To administer first aid for frostbite: Take the victim indoors and re-warm the areas quickly in water that is between 39 °C and 41 °C (102 °F-105 °F). Give a warm drink - not coffee, tea or alcohol. The victim must not smoke. Keep the frozen parts in warm water or covered with warm clothes for 30-minutes, even though the tissue will be very painful as it thaws. Then elevate the injured area and protect it from injury. Do not allow blisters to be broken. Use sterile, soft, dry material to cover the injured areas. Keep victim warm and get immediate medical care.

After thawing, the victim should try to move the injured areas a little, but no more than can be done alone, without help. Note:

- Do *not* rub the frostbitten part (this may cause gangrene).
- Do *not* use ice, snow, gasoline or anything cold on the frostbitten area.
- Do *not* use heat lamps or hot water bottles to re-warm the part.
- Do *not* place the part near a hot stove.

Hypothermia

Systemic hypothermia is caused by exposure to freezing or rapidly dropping temperature; its symptoms are usually exhibited in four stages:

- Uncontrollable shivering, numbness, dizziness, giddiness, disorientation.
- Apathy, listlessness, sleepiness, and (sometimes) rapid cooling of the body to less than 95 °F.
- Unconsciousness, glassy stare, slow pulse, and slow respiratory rate.
- Freezing of the extremities.

Hypothermia is a very serious condition, and if left untreated, may result in death. To treat hypothermia:

After decontamination, carefully remove wet clothing if not frozen to skin. Remove victim to a warm area and, if conscious, administer warm fluids. Loosen clothing which might restrict circulation and wrap victim in warm blankets. DO NOT GIVE ANY FLUIDS CONTAINING ALCOHOL as alcohol will further lower the body temperature. Monitor for shock.

Report the illness to the Medical Monitoring Physician.

As a general rule field activities shall be curtailed if equivalent chill temperature (°F) as defined in Table 2 is below zero (0 °F) unless the activity is of an emergency nature.

Table 2. Cooling Power On Exposed Flesh As An Equivalent Temperature Under Calm Conditions

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	LITTLE DANGER In <hr with dry skin. Maximum danger of false sense of security.				INCREASING DANGER Danger from freezing of exposed flesh within one minute.			GREAT DANGER Flesh may freeze within 30 seconds.				
Trenchfoot and immersion foot may occur at any point on this chart.												

* Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA.

SOURCE: ACGIH, Threshold Limit Values for Chemical Substances in the Work Environment for 1984-1985.

APPENDIX G

BIOLOGICAL AND CHEMICAL HAZARD PROCEDURES

APPENDIX G
BIOLOGICAL AND CHEMICAL HAZARD PROCEDURES

Biological Hazards and Controls

Ants, Bees, Wasps, and Hornets

Stings from these insects are responsible for more deaths in the United States than bites and stings of all other venomous creatures. This is due to the victim's sensitization to the venom from repeated stings, which can result in anaphylactic reactions. The stinger may remain in the skin and should be removed by teasing or scraping rather than pulling. An ice cube placed over the sting will reduce pain. An analgesic-corticosteroid lotion is often useful. People with known hypersensitivity to such stings should carry a kit containing an antihistamine and epinephrine.

Recently African "killer" bees have been found in Texas. Fatalities associated with these bees have resulted when the victim has sustained incapacitating injuries from a fall or slip and cannot escape the bees. The "killer" bees have the ability to sting repeatedly. Their venom is no more potent than that of the common honey bee. Observe the same first aid procedures as those stated in the previous paragraph.

Poisonous Snakes

Avoid walking at night or in grass and underbrush. Do not climb rocky ledges without first visually inspecting them. Wear high-top boots and heavy pants; more than half of all bites are on the lower parts of the legs. Do not attempt to kill snakes unnecessarily; many people are bitten in such an attempt.

A snake may bite a person and not inject venom. Symptoms and signs of envenomation include the presence of fang marks; rapid and progressive swelling around the bitten area within five to 10 minutes; pain; weakness; faintness; nausea; vomiting; and alterations in temperature, pulse, and blood pressure. Emergency treatment does not include incision through the fang marks. Typically, that causes more harm than good. Immobilize the person and the bitten part in a horizontal position, with the bitten part lower than the heart. Wash the bitten area with water but avoid manipulation of the bitten area. Do not allow the person to walk, run, or drink alcoholic beverages or stimulants such as soda, coffee, or tea. Do not apply ice or give aspirin. Treat for shock and transport to the nearest medical facility. Death in humans can occur within less than one hour to several days, with most deaths occurring between 18 and 32 hours after the bite.

Spiders

Almost all of the 30,000 species of spiders are venomous, but only a relatively small number have fangs long and strong enough to penetrate the human skin. Spiders are generally found in dark protected areas such as access ways to sanitary sewers, under ledges, or in pump housings and buildings.

Black widow spiders range in color from gray to brown to black, depending on the species. The abdomen is shiny black with a red hourglass or red spots. Although both male and female are venomous, only the latter has fangs large and strong enough to penetrate human skin. Mature females range in body length from 10 to 18 mm. The person who was bitten may recall receiving a sharp, pinprick-like bite, but in some cases the bite is so minor that it goes unnoticed. Rarely is there any local skin reaction. The initial pain is sometimes followed by a dull, occasionally numbing pain in the affected extremity, and by pain and cramps in one or several of the large body muscles. Sweating, weakness, and varying degrees of headache and dizziness are common. The lymph nodes in the region of the bite will often be tender or painful. In severe cases, there is rigidity of the abdominal muscles and pain in the lower back, thighs, or abdomen. There is no effective first-aid treatment. Treat for shock and transport to the nearest medical facility.

Brown Recluse or Violin Spiders have abdomens that vary in color from grayish through orange and reddish-brown to dark brown. The back shell of the "violin" is brown to blackish and distinct from the pale yellow to reddish-brown background of the head and chest. This spider has 6 eyes grouped in 3 diads. Both male and female are venomous. They average 6 to 12 millimeters in body length. The bite of this spider produces about the same degree of pain as the sting of an ant, but sometimes the person is completely unaware of the bite. In most cases, a localized burning sensation develops, which may last for 30 to 60 minutes. The area often itches and becomes red and warm with a small blanched area around the immediate bite site. The reddened area enlarges and becomes purplish during the subsequent one to 8 hours. A small blister forms at the bite site, increases in size, and subsequently ruptures. The entire area may become swollen and painful. Other signs and symptoms include fever, malaise, stomach cramps, nausea, and vomiting. In severe cases, there may be breakdown of the red blood cells, renal failure, or death. All first aid measures should be avoided as the natural appearance of the bite is most important in determining the diagnosis. A cube of ice may be placed on the wound. Transport to the nearest medical facility.

Ticks

Ticks can carry many diseases. Transmission of Lyme disease from ticks to persons has been studied. There is evidence that symptoms of the disease are not immediately apparent but begin after a period of time has passed. When in the field, check often for ticks. Ticks are best removed by applying gasoline or by slowly withdrawing the tick with flat-tip tweezers. Care should be taken not to leave any part of the tick in the wound and not to crush the tick. If the tick resists or cannot be completely removed, seek medical attention. The bite should be cleansed and a corticosteroid lotion should be applied.

One of the symptoms of Lyme disease is a rash that looks like a "bulls-eye" with a small welt in the center. The rash visually develops several days to several weeks after the tick bite. Rocky Mountain Spotted Fever, which is also transmitted by ticks, also causes a rash of red spots under the skin 3 to 10 days after the bite. Both diseases cause chills, fever, headache, fatigue, stiff neck, and bone pain. Medical attention should be sought if these symptoms occur.

Poisonous Plants

Poison oak and poison ivy are bush-like plants. Poison oak and poison ivy are identified by three or five leaves radiating from a stem. The plant tissues have an oleoresin that is active in live, dead, and dried parts. The oleoresin may be carried by smoke, dust, contaminated clothing, and animal hair. Signs and symptoms include redness, swelling, and sometimes intense itching. Blisters form during the subsequent 24 hours. Crusting and scaling occur within a few days. In the absence of complications, healing is complete in approximately 10 days. Wash any exposed skin with a mild soap and water but do not scrub the area.

Rodents

Recently, a fatal respiratory illness has been associated with a Hantavirus. This respiratory illness has symptoms similar to the flu. Without medical intervention, the victim experiences respiratory and cardiac failure. This virus is shed in the droppings and urine of infected rodents, mice, and rats.

Any droppings (small rod-like, dry material), nesting activities, or dead animals are to be reported immediately to the SHSC or SM. A decision will be made as to the proper method of eliminating the infestation and cleaning up droppings.

Generic Chemical Hazard Profiles

The following information is intended to be generic to provide a brief overview. Detailed information relevant to hazards associated with specific chemical substances of potential concern at this site are provided in Appendix K.

Calibration Gases

Common pressurized gases used to calibrate air monitoring instrumentation include heptane, hexane, hydrogen, hydrogen sulfide, oxygen, and pentane. Under ambient conditions, these gases are flammable. The cylinders are pressurized; they can become mini-torpedoes if the valve stem is severed from the cylinder. Handle them carefully.

The primary routes of entry into the body are inhalation and skin absorption, so these substances should be handled in a well-ventilated area. Symptoms of exposure include lightheadedness, nausea, headache, numb extremities, dermatitis, loss of appetite, chemical pneumonia, and giddiness. Exposure to elevated levels of such gases can damage the skin, eyes, and respiratory system, and can cause death.

Corrosives

Corrosives include acids, bases/caustics, and inorganic halogen salts. Some of the more common acids include acetic, citric, hydrochloric, hydrofluoric, nitric, perchloric, phosphoric, picric, and sulfuric acids. Some of the more common caustics include ammonia, ammonium hydroxide, potassium hydroxide, sodium hydroxide, and sodium hypochlorite. Inorganic halogen salts are compounds containing halogens (chlorine, bromine, fluorine) such as sodium chloride, potassium bromate, and sodium fluoride, which are corrosive to metals and finishes but are relatively insignificant health threats.

For the most part, corrosives are nonflammable, although the liquid forms are moderately to highly volatile. Perchloric acid (perchlorates) and picric acid when dry can be explosive.

The primary routes of entry into the body are by inhalation, ingestion, and skin contact. Symptoms of exposure include tissue burns, nose and throat inflammation, and pulmonary edema. Corrosives can cause extensive damage to the respiratory system, skin, and eyes.

Metals

Metals commonly associated with batteries, paints, plating operations, and petroleum-based products include lead, arsenic, cadmium (a probable human carcinogen), chromium (a probable human carcinogen), copper, nickel, silver, tin, and zinc compounds. Petroleum-based products such as lubricants and especially leaded gasolines, contain organic lead compounds such as tetraethyl and tetramethyl lead, as well as assorted inorganic metals mentioned above and others such as antimony, barium, beryllium, cobalt, magnesium, manganese, and vanadium. Explosive powders used in ordnances also contain aluminum.

Metals pose a health hazard in their solid form, especially as airborne dusts. The primary routes of entry into the body are by inhalation, ingestion, and skin contact. Organic compounds such as tributyltin may penetrate the skin without producing appreciable local injury. Symptoms of exposure include eye, skin, and upper respiratory system irritation; headaches; insomnia; metallic taste in the mouth; lassitude; pallor; anorexia; constipation; abdominal pain; anemia; and tremors. Heavy metals can cause damage to the central nervous system, kidneys, respiratory system, and liver. Cancers of the lungs and bones are associated with metal intoxication.

Petroleum-Based Hydrocarbons

Lubricants, oils, fuels, and gasoline contain petroleum-based hydrocarbons such as benzene and its derivatives, naphthas, toluene, xylenes, and coal tar pitch volatiles. Coal tar pitch volatiles are also known as polycyclic hydrocarbons (PCHs) or polynuclear aromatics (PNAs). Benzene and PNAs are known carcinogens. Petroleum-based hydrocarbon materials also generally contain metal contaminants. (Refer to the metals profile.) Lubricants and waste oils are slightly to highly volatile and flammable. Fuels and gasoline are extremely volatile and flammable.

The primary routes of entry into the body are by ingestion and skin contact or dermal absorption. Inhalation of the more volatile constituents, such as toluene, xylenes, naphthas, and benzene (a known human carcinogen) and its derivatives, can be toxic. Acute symptoms of exposure include eye, skin, and upper respiratory system irritation, giddiness, confusion, headache, nausea, staggered gait, and fatigue. High-level and chronic exposure can cause damage to the liver, kidneys, and bone marrow, and can cause skin cancer and leukemia.

Solvents (Nonhalogenated) and Paints

Some of the more common constituents of nonhalogenated solvents and paint wastes include acetone, methyl ethyl ketone (MEK), toluene, xylenes, alkyl acetates, acrylates, and alcohols. These substances are slightly to highly volatile and are moderately to highly flammable.

Primary routes of entry into the body are by inhalation, ingestion, and dermal absorption. Symptoms of exposure include irritation of the eyes, skin, or upper respiratory system, headaches, drowsiness, dermatitis, dizziness, confusion, giddiness, and euphoria. Higher levels of exposure can cause narcosis and damage to the kidneys and blood.

APPENDIX H

DECONTAMINATION PROCEDURES

APPENDIX H
DECONTAMINATION PROCEDURES

Contamination Reduction Corridor

An area within the Contamination Reduction Zone (CRZ) is designated the Contamination Reduction Corridor (CRC). The CRC controls access into and out of the Exclusion Zone and confines personnel decontamination activities to a limited area. The size of the corridor depends on the number of stations in the decontamination procedure, overall dimensions of work control zones, and amount of space available at the site. Whenever possible, it should be a straight path.

The CRC boundaries should be conspicuously marked, with entry and exit restricted. The far end is the hotline - the boundary between the Exclusion Zone and CRZ. Personnel exiting the Exclusion Zone must go through the CRC. Anyone in the CRC should be wearing the Level of Protection designated for the decontamination crew. Another corridor may be required for the entrance and exit of heavy equipment needing decontamination. Within the CRC, distinct areas are set aside for decontamination of personnel, portable field equipment, removed clothing, etc. These areas should be marked and personnel restricted to those wearing the appropriate Level of Protection. All activities within the corridor are confined to decontamination.

Personnel protective clothing, respirators, monitoring equipment, sampling supplies, etc., are all maintained outside of the CRC. Personnel don their protective equipment away from the CRC and enter the Exclusion Zone through a separate access control point at the hotline.

Extent of Decontamination Required

The original decontamination plan must be adapted to specific conditions found at sites. These conditions may require more or less personnel decontamination than planned, depending on a number of factors:

- *Type of Contaminant.* The extent of personnel decontamination depends on the effects the contaminants have on the body. The more toxic a substance is, the more extensive or thorough decontamination must be. Whenever it is known or suspected that personnel can become contaminated with highly toxic or skin-destructive substances, a full decontamination procedure should be followed. If less hazardous materials are involved, the procedure can be downgraded.
- *Amount of Contamination.* The amount of contamination on protective clothing is usually determined visually. If clothing is badly contaminated, a thorough decontamination is generally required. Gross material remaining on the protective clothing for any extended period of time may degrade or permeate it. This likelihood increases with higher air concentrations and greater amounts of liquid contamination. Gross contamination also increases the probability of personnel contact. Wipe tests may help determine the type and quantity of surface contaminants.

- *Level of Protection.* The Level of Protection and specific pieces of clothing worn determine, on a preliminary basis, the layout of the decontamination line. Each Level of Protection incorporates different problems in decontamination and doffing of the equipment. For example decontamination of the harness straps and backpack assembly of the self-contained breathing apparatus is difficult. A butyl rubber apron worn over the harness makes decontamination easier. Clothing variations and different Levels of Protection may require adding or deleting stations in the original decontamination procedure; however, added clothing can contribute to heat stress and must be considered from this viewpoint.
- *Work Function.* The work each person does determines the potential for contact with hazardous materials. In turn, the work dictates the layout of the decontamination line. Observers, photographers, operators of air samplers, or others in the Exclusion Zone performing tasks that may not bring them in contact with contaminants may not need, for example, to have their garments washed and rinsed. Others in the Exclusion Zone with a potential for direct contact with the hazardous material will require more thorough decontamination. Different decontamination lines could be set up for different job functions, or certain stations in a line could be omitted for personnel performing certain tasks.
- *Location of Contamination.* Contamination on the upper areas of protective clothing poses a greater risk to the worker because volatile compounds may generate hazardous levels of airborne contamination breathing concentration both for the worker and for the decontamination personnel. There is also an increased probability of contact with skin when doffing the upper part of clothing.
- *Reason for Leaving Site.* The reason for leaving the Exclusion Zone also determines the need and extent of decontamination. A worker leaving the Exclusion Zone to pick up or drop off tools or instruments and immediately returning may not require decontamination. A worker leaving to get a new air cylinder or change a respirator or canisters, however, may require some degree of decontamination. Individuals departing the CRC for a break, lunch, end of day, etc., must be thoroughly decontaminated.
- *Effectiveness of Decontamination.* There is no method to immediately determine how effective decontamination is in removing contaminants. Discolorations, stains, corrosive effects, and substances adhering to objects indicate contaminants have not been removed; however, observable effects only indicate surface contamination and not permeation (absorption) into clothing. Also many contaminants are not readily visible to the eye.

Decontamination Equipment and Solutions

Decontamination equipment, materials, and supplies are generally selected based on availability, ease of decontamination and disposability. Most equipment and supplies can be easily procured. For example, soft-bristle scrub brushes or long-handle brushes are used to remove contaminants. Water in buckets or garden sprayers are used for rinsing. Large galvanized wash tubs, stock tanks, or wading pools can hold wash and rinse solutions. Large plastic garbage cans or other similar containers lined with plastic bags store contaminated clothing and equipment. Contaminated liquids can be stored temporarily in metal or plastic cans or drums. Other gear includes paper or cloth towels for drying protective clothing and equipment.

Personnel protective equipment, sampling tools, and other equipment are usually decontaminated by scrubbing with detergent-water (such as Alconox) using a soft-bristle brush followed by rinsing with copious amounts of water. Solvents are usually used with sampling gear, not protective gear. The appropriate decontamination solution must be selected in consultation with an experienced chemist. Clothing which is heavily contaminated or cannot be decontaminated should be properly disposed of.

Establishment Of Procedures

Once decontamination procedures have been established, all personnel requiring decontamination must be given precise instructions (and practice, if necessary). Compliance must be frequently checked. The time it takes for decontamination must be ascertained. Personnel wearing SCBAs must leave their work area with sufficient air to walk to the CRC and go through decontamination. Disposal of decon solutions, clothing and other material should be considered and checked with local, state and federal authorities.

Decontamination During Medical Emergencies

Part of overall planning for site activities is managing medical emergencies. The plan should provide for:

- Team members fully trained in first aid and CPR.
- Arrangements with the nearest medical facility for transportation and treatment of injured, and for treatment of personnel suffering from exposure to chemicals.
- Consultation services with a toxicologist.
- Emergency eye washes, showers, and/or wash stations.
- First aid kits, blankets, stretcher, and resuscitator.

In addition, the plan should have established methods for decontaminating personnel with medical problems and injuries. There is the possibility that the decontamination may aggravate or cause more serious health effects. If prompt life-saving first aid and/or medical treatment is required, decontamination procedures should be omitted. Whenever possible, response personnel should accompany contaminated victims to the medical facility to advise on matters involving decontamination.

Physical injuries can range from a sprained ankle to a compound fracture, from a minor cut to massive bleeding. Depending on the seriousness of the injury, treatment may be given at the site by trained personnel. For more serious injuries, additional assistance may be required at the site, or the victim may have to be treated at a medical facility.

Life-saving care should be instituted immediately without considering decontamination. The outside garments can be removed (depending on the weather) if they do not cause delays, interfere with treatment, or aggravate the problem. Respiratory masks and backpack assemblies must always be removed. Fully encapsulating suits or chemical-resistant clothing can be cut away. If the outer contaminated garments cannot be safely removed, the individual should be wrapped in plastic, rubber, or blankets to help prevent contaminating the inside of ambulances and/or medical personnel. Outside garments are then removed at the medical facility. No attempt should be made to wash or rinse the victim. One exception would be if it is known that the individual has been contaminated with an extremely toxic or corrosive material which could also cause severe injury or loss of life. For minor medical problems or injuries, the normal decontamination procedure should be followed.

Heat-related illnesses range from heat fatigue to heat stroke. Heat stroke requires prompt treatment to prevent irreversible damage or death. Protective clothing may have to be cut off. Less serious forms of heat stress require prompt attention or they may lead to a heat stroke. Unless the victim is obviously contaminated, decontamination should be omitted or minimized and treatment begun immediately. Appendix F presents a discussion of symptoms of heat stress and the recommended treatment procedures.

Exposure to chemicals can be divided into two categories:

- Injuries from direct contact such as acid burns or inhalation of toxic chemicals.
- Potential injury due to gross contamination on clothing or equipment.

For the contaminant inhaled, treatment can only be given by qualified physicians. If the contaminant is on the skin or in the eyes, immediate measures must be taken to counteract the substance's effect. First aid usually involves flooding the affected area with water; however, for a few chemicals, water may cause more severe problems.

When protective clothing is grossly contaminated, contaminants may be transferred to treatment personnel or the wearer and cause injuries. Unless severe medical problems have occurred simultaneously with splashes, the protective clothing should be washed off as rapidly as possible and carefully removed. Workers showing symptoms of acute exposure should be transported immediately following appropriate decontamination to the nearest medical facility.

Level of Protection For Decontamination Workers

The Level of Protection worn by decontamination workers is determined by:

- Expected or visible contamination on workers.
- Type of contaminant and associated respiratory and skin hazards.
- Total vapor/gas concentrations in the CRC.
- Particulates and specific inorganic or organic vapors in the CRC.
- Results of swipe tests.
- The presence (or suspected presence) of highly toxic or skin-destructive materials.

In most instances, decontamination workers are in the same Level of Protection as site workers. The standard selection criteria apply.

Monitoring Equipment Decontamination

Insofar as possible, measures should be taken to prevent contamination of monitoring equipment. Monitoring instruments, unless they are splashed, usually do not become contaminated. Once contaminated, instruments are difficult to clean without damaging them. Any delicate instrument which cannot be decontaminated easily should be protected while it is being used. It should be bagged, and the bag taped and secured around the instrument. Openings are made in the bag for sample intake. Note: some plastics or other materials may interfere or increase readings. Ventilation ports should not be covered.

Heavy Equipment Decontamination

Drill rigs, bulldozers, trucks, back-hoes, bulking chambers, and other heavy equipment are difficult to decontaminate. The method generally used is to wash them with water under high pressure and/or to scrub accessible parts with a detergent/water solution under pressure, if possible. In some cases, shovels, scoops, and lifts have been sand blasted or steam cleaned. Particular care must be given to those components in direct contact with contaminants such as tires and scoops. Swipe tests should be utilized to measure effectiveness. During cleaning under high temperature/pressure volatilization of compounds takes place. (Note that moisture, especially steam can increase the breakdown of air purifying respirator cartridges).

Disposal Of Decontamination Solutions

All contaminated equipment must be disposed of properly. Clothing, tools, buckets, brushes, and all other equipment that is contaminated must be secured in drums or other containers, labeled, and properly disposed.

Clothing and other equipment not completely decontaminated on site should be secured in plastic bags before being removed from the site.

Spent decontamination solutions are transferred to drums, which are labeled and properly disposed.

The following procedures will be used to decontaminate soil and groundwater sampling equipment to prevent cross contamination of samples. The following procedures meet applicable EPA protocols for sampling equipment decontamination.

Sampling Equipment Decontamination

<u>Field setup</u>

To prevent cross contamination from decontamination washing and rinsing overspray during the procedure, the following field setup protocol will be followed.

1) One 5-foot folding table, covered in sheet plastic draping down onto the ground to provide a walking area will be used for washing and rinsing activities.
2) One 5-foot folding table, covered in sheet plastic draping down onto the ground to provide a walking area will be used for air drying and temporary storage activities.
3) A plastic tub can be used for non-phosphate detergent washes.
4) Stiff long-handled nonmetallic bristle scrub brushes will be used.

5) Stainless steel pans with perforated trays will be used for tap water draining, methanol and hexane rinsing, and American Society for Testing and Materials (ASTM) Type II water rinsing (one each - three total), and will be used exclusively for each activity.
6) Small laboratory rinse bottles will be used for pesticide grade solvent rinsing.
7) Stainless steel sprayers (up to 5 gallon capacity) will be used for tap water and ASTM Type II water rinsing, and will be used exclusively for each activity.
8) Potable water (tap water) must come from a single source and must be subjected to periodic QC analysis; the single source location for the potable water will be from the location directed by the site manger or designee.

Sampling equipment - metal

All metal sampling equipment, including stainless steel bailers, split-spoon samplers, sample sleeves, hand augers and sample cutting knives used to collect samples for organics or metals analysis will be decontaminated according to the following procedure before each sample is taken.

1) Knock off or prescrub with tap water in a plastic tub.
2) Discard prescrub tap water and replace with clean tap water when it becomes visibly dirty and discolored.
3) Scrub clean with a stiff, long-handled, nonmetallic scrub brush and a non-phosphate detergent and tap water solution (Liquinox or equivalent) in a plastic tub.
4) Replace the non-phosphate detergent and tap water solution when it becomes visibly dirty and discolored.
5) Rinse with tap water.
6) Rinse with ASTM Type II water.
7) Rinse with methanol (methyl alcohol, pesticide grade or equivalent).
8) Rinse with pesticide grade hexane.

Place clean sampling equipment in a clean area on the drying table and allow it to air dry. If the decontaminated sampling equipment will not be used immediately, place it in suitably sized plastic bags. Seal with a signed, dated custody seal. Label the plastic bags "clean" and store in a contaminant-free environment.

Sampling equipment - teflon and other plastics

Teflon bailers or any other plastic equipment used to collect samples for organics or metals analysis will be decontaminated as follows.

1) Scrub with a non-phosphate detergent and tap water solution (Liquinox or equivalent) in a plastic tub.
2) Replace the non-phosphate detergent and tap water solution when it becomes dirty and discolored.

3) Rinse with tap water.

4) Rinse with ASTM Type II water.

5) Rinse with methanol (methyl alcohol, pesticide grade or equivalent).

6) Rinse with pesticide grade hexane.

Place clean sampling equipment in a clean area on the drying table and allow it to air dry. If the decontaminated sampling equipment will not be used immediately, place it in suitably sized plastic bags. Seal with a signed, dated custody seal. Label the plastic bags "clean" and store in a contaminant-free environment.

Documentation

The following information (at a minimum) must be logged into a field notebook to demonstrate that the decontamination procedure was performed properly.

1) Date

2) Site Location

3) Decontamination procedures and solutions used

4) Type of equipment decontaminated (manufacturer's name, model, and serial number as applicable)

5) Special or unusual conditions or problems (e.g., wind, ambient air conditions, etc.)

6) Storage location for clean equipment not immediately used.

APPENDIX I

WORK ZONE PROCEDURES

APPENDIX I
WORK ZONE PROCEDURES

Zone 1: Exclusion Zone

The Exclusion Zone, the innermost of three concentric areas, is the zone where contamination does, or could, occur. All people entering the Exclusion Zone must wear prescribed Levels of Protection. An entry and exit check point must be established at the periphery of the zone to regulate the flow of personnel and equipment into and out of the zone and to verify that the established procedures to enter and exit are followed.

The outer boundary of Zone 1, the Hotline, is initially established by visually surveying the immediate environs of the site or incident and determining where the hazardous substances involved are located; where any drainage, leachate, or spilled material is; and whether any soil discolorations are visible. Guidance in determining the boundaries is also provided by data from the initial site survey indicating the presence of contaminated air, water or soil, the presence of combustible gases, radiation, or an oxygen deficient atmosphere.

Additional factors that should be considered include the distances needed to prevent fire or an explosion from affecting personnel outside the zone, the physical area necessary to conduct site operations, and the potential for contaminants to be blown from the area. Once the Hotline has been determined, it should be physically secured, fenced, or well-defined by landmarks. During subsequent site operations, the boundary may be modified and adjusted as more information becomes available.

All personnel within the Exclusion Zone must wear the required Level of Protection. Personnel protective equipment is designated based on site-specific conditions, including the type of work to be done and the hazards that might be encountered. Frequently within the Exclusion Zone, different Levels of Protection are justified. Sub-areas are specified and conspicuously marked as to whether Level A, B, or C Protection is required. The Level of Protection is determined by the measured concentration of substances in air, potential for contamination, and the known or suspected presence of highly toxic substances.

Different Levels of Protection in the Exclusion Zone might also be designated by job assignment. For example, collecting samples from open containers might require Level B protection, while for walk-through ambient air monitoring Level C protection might be sufficient. The assignment, when appropriate, of different Levels of Protection within the Exclusion Zone generally provides a more flexible, effective, and less costly operation, while still maintaining a high degree of safety.

Zone 2: Contamination Reduction Zone

Between the Exclusion Zone and the Support Zone is the Contamination Reduction Zone, which provides a transition between contaminated and clean zones. Zone 2 serves as a buffer to further reduce the probability of the clean zone becoming contaminated or being affected by other existing hazards. It provides additional assurance that the physical transfer of contaminating substances by people, equipment, or in the air is limited through a combination of decontamination, distance between Exclusion and Support Zones, air dilution, zone restrictions, and work functions.

Initially, the Contamination Reduction Zone is considered to be a non-contaminated area. At the boundary between Exclusion and Contamination Reduction Zones, decontamination stations are established, one for personnel and one for heavy equipment. These stations should be separated by a minimum of 3 feet or more, such as when steam cleaning is used. Depending on the size of the operation, more than two stations may be necessary. Exit from the Exclusion Zone is through a decontamination station.

As operations proceed, the area around the decontamination station may become contaminated, but to a much lesser degree than the Exclusion Zone. On a relative basis, the amount of contaminants should decrease from the Hotline to the Support Zone due to the distance involved and the decontamination procedures used.

The boundary between the Support Zone and the Contamination Reduction Zone, the Contamination Control Line, separates the possibly low contamination area from the clean Support Zone. Access to the Contamination Reduction Zone from the Support Zone is through a control point. Personnel entering there would wear the prescribed personnel protective equipment, if required, for working in the Contamination Reduction Zone. Entering the Support Zone from the Contamination Reduction Zone requires removal of any protective equipment worn in the Contamination Reduction Zone.

Zone 3: Clean Zone

The Clean Zone, the outermost part of the site, is considered a non-contaminated or clean area. Support equipment (command post, equipment trailer, etc.) is located in the zone; traffic is restricted to authorized response personnel. Since normal work clothes are appropriate within this zone, potentially contaminated personnel clothing, equipment, and samples are not permitted, but are left in the Contamination Reduction Zone until they are decontaminated.

The location of the command post and other facilities in the Clean Zone depends on a number of factors, including:

- *Accessibility*: topography, open space available, locations of highways and railroad tracks, or other limitations.
- *Wind direction*: preferably the support facilities should be located upwind of the Exclusion Zone; however, shifts in wind direction and other conditions may be such that an ideal location based on wind direction alone does not exist. Therefore, a greater distance from the hot area may be required.
- *Resources*: adequate roads, power lines, water, shelter, and sanitation.

Considerations When Establishing Work Zones

The distances between the Hotline, Contamination Control Line, and command post, and the size and shape of each zone have to be based on specific site conditions. Considerable judgment is needed to ensure that the distances between zone boundaries are large enough to allow room for the necessary operations, provide adequate distance to prevent the spread of contaminants, and eliminate the possibility of injury due to explosion or fire. Long-term operations would involve developing reasonable methods to determine if material is being transferred between zones and to assist in modifying site boundaries.

The following criteria should be considered in establishing area dimensions and boundary distances:

- Physical and topographical features of the site.
- Weather conditions.
- Field/laboratory measurements of air contaminants and environmental samples.
- Air dispersion calculations.
- Potential for explosion and flying debris.
- Physical, chemical, toxicological, and other characteristics of the substances present.
- Cleanup activities required.
- Potential for fire.
- Area needed to conduct operations.
- Decontamination procedures.
- Dimensions of contaminated area.
- Potential for exposure.
- Surrounding industries or other sources of contamination other than the site itself.

Other Considerations in Establishing Work Zones

The use of a three-zone system, access control points, and exacting decontamination procedures provides a reasonable assurance against the translocation of contaminating substances. This site control system is based on a "worst case" situation. Less stringent site control and decontamination procedures may be utilized if more definitive information is available on the substances involved and the hazards they present. This information can be obtained through air monitoring, instrument survey and sampling, and technical data concerning the characteristics and behavior of materials present.

APPENDIX J

THIRD PARTY GUIDELINES

APPENDIX J
THIRD PARTY GUIDELINES

A third party is any individual or organization not in a direct contractual working relationship with TEC. An important concept in understanding third party protection is that HSPs are primarily *occupational plans*; i.e., they are designed to assure the health and safety of the worker. An HSP usually does not provide the risk assessment and/or endangerment assessment necessary to judge potential harm to third parties.

Another important concept is that in all instances, TEC interests require rigorous enforcement of all aspects of health and safety, particularly with regard to third parties.

Protection of third parties is generally associated with site control and implementation of appropriate site investigation protocols, monitoring, and remedial response procedures. Techniques such as fencing, posting of contaminated areas, and providing a 24-hour guard are some of the major mechanisms whereby third parties can be protected. In all instances, third parties visits will be logged into the Site Visitors Log, or other appropriate document.

In order to protect third parties, the HSM and SHSM may be required to work closely with representatives of the public. A public relations specialist may have to be designated.

TEC employees cannot stop the actions of parties not under direct contractual agreement with TEC unless specifically stated in the HSP. This includes Federal and State employees, as well as Potential Responsible Parties (PRPs).

TEC employees are required to make a "good faith" effort to inform third parties of potential hazards. Note, however, that documents such as the HSPM and the HSP may not be released to the public without first obtaining concurrence and permission from the client through the Project Manager (PM) and the CHSM. Any individual scheduled to visit the site must review the HSP and document his/her review on the Visitor/Trainee Agreement Form included in Appendix K.

TEC employees shall document any action by any individual (including Federal and State employees and PRPs) that is in violation of the HSPM or HSP. The written account of the episode is forwarded to the HSM in charge of the site or operation and recorded in the Visitors Log.

Note that work may have to cease if the actions of a third party in any way compromise the policies and procedures of the HSPM. In addition, the SHSM or HSM may have to suspend site operations in order to protect the health and safety of third parties.

Potential subcontractors may be required to visit a site or operation for the purpose of estimating cost, or obtaining other appropriate and necessary information. The regional office or subsidiary HSM is required to determine if HSPM requirements apply to the visit. If they do not, the subcontractor is exempted from HSPM requirements. The *Bidders Conference Agreement Form* (TEC 1992), or equivalent, is executed to protect TEC and subcontractor interests. If the standard form is not used, any modification must be approved by TEC's Corporate Legal Department.

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APPENDIX K

MATERIAL SAFETY DATA SHEETS (MSDSs)

DOD Hazardous Materials Information System
DoD 6050.5-LR
AS OF August 1994
Proprietary Version - For U.S. Government Use Only

FSC: 6810
NIIN: 002815272
Manufacturer's CAGE: 63415
Part No. Indicator: A
Part Number/Trade Name: BENZENE ASTM D 836-84

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General Information

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Item Name: BENZENE, TECHNICAL *
Manufacturer's Name: SPECTRUM CHEMICAL MANUFACTURING CORP. *
Manufacturer's Street: 14422 SOUTH SAN PEDRO *
Manufacturer's P. O. Box:
Manufacturer's City: GARDENA *
Manufacturer's State: CA *
Manufacturer's Country: US *
Manufacturer's Zip Code: 90248-2027 *
Manufacturer's Emerg Ph #: 800-424-9300 *
Manufacturer's Info Ph #: 213-516-8000 *
Distributor/Vendor # 1: CHEMICAL COMMODITIES AGENCY, INC. *
Distributor/Vendor # 1 Cage: 60777 *
Distributor/Vendor # 2:
Distributor/Vendor # 2 Cage:
Distributor/Vendor # 3:
Distributor/Vendor # 3 Cage:
Distributor/Vendor # 4:
Distributor/Vendor # 4 Cage:
Safety Data Action Code: C
Safety Focal Point: D
Record No. For Safety Entry: 004
Tot Safety Entries This Stk#: 005
Status: SM *
Date MSDS Prepared: 00DEC93 *
Safety Data Review Date: 05JUL94 *
Supply Item Manager: CX *
MSDS Preparer's Name: C.A.EISENHARD *
Preparer's Company: CHEMICAL COMMODITIES AGENCY INC
Preparer's St Or P. O. Box: 27447 PACIFIC STREET
Preparer's City: HIGHLAND
Preparer's State: CA
Preparer's Zip Code: 92346-2640
Other MSDS Number:
MSDS Serial Number: BLZFG
Specification Number: ASTM D 836-84 *
Spec Type, Grade, Class: TECHNICAL *
Hazard Characteristic Code: F3 *
Unit Of Issue: GL *
Unit Of Issue Container Qty: 1 GAL *
Type Of Container: CAN *
Net Unit Weight: 7.3 LBS *
NRC/State License Number: N/R *
Net Explosive Weight: N/R *
Net Propellant Weight-Ammo: N/R *
Coast Guard Ammunition Code: N/R *

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Ingredients/Identity Information
==

Proprietary: NO *
Ingredient: BENZENE (SARA III) *
Ingredient Sequence Number: 01
Percent: >99 *
Ingredient Action Code: C
Ingredient Focal Point: D
NIOSH (RTECS) Number: CY1400000 *
CAS Number: 71-43-2 *
OSHA PEL: SEE 1910.1028 *
ACGIH TLV: 10 PPM; A2; 9394 *
Other Recommended Limit: NONE SPECIFIED *

Proprietary: NO *
Ingredient: NON-AROMATICS *
Ingredient Sequence Number: 02
Percent: <0.15 *
Ingredient Action Code: C
Ingredient Focal Point: D
NIOSH (RTECS) Number: 1009830NA *
CAS Number: UNKNOWN *
OSHA PEL: NOT ESTABLISHED *
ACGIH TLV: NOT ESTABLISHED *
Other Recommended Limit: NONE RECOMMENDED *

Proprietary: NO *
Ingredient: THIOPHENE *
Ingredient Sequence Number: 03
Percent: <1 *
Ingredient Action Code: C
Ingredient Focal Point: D
NIOSH (RTECS) Number: XM7350000 *
CAS Number: 110-02-1 *
OSHA PEL: NOT ESTABLISHED *
ACGIH TLV: NOT ESTABLISHED *
Other Recommended Limit: NONE RECOMMENDED *

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Physical/Chemical Characteristics
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Appearance And Odor: COLORLESS TO LIGHT-YELLOW LIQUID WITH AN AROMATIC ODOR. *
Boiling Point: 176F,80C *
Melting Point: 42.0F,5.6C *
Vapor Pressure (MM Hg/70 F): 75 @20C *
Vapor Density (Air=1): 2.8 (AIR=1 *
Specific Gravity: 0.8765 *
Decomposition Temperature: UNKNOWN *
Evaporation Rate And Ref: 5.1 (N-BUTYL ACETATE=1) *
Solubility In Water: SLIGHT *
Percent Volatiles By Volume: N/K *
Viscosity: UNKNOWN *
pH: N/R *
Radioactivity: N/R *
Form (Radioactive Matl): N/R *
Magnetism (Milligauss): N/R *

Corrosion Rate (IPY): UNKNOWN *
Autoignition Temperature: 1044F

Fire and Explosion Hazard Data

Flash Point: 12F,-11C *
Flash Point Method: CC *
Lower Explosive Limit: 1.2 *
Upper Explosive Limit: 7.8 *
Extinguishing Media: USE WATER SPRAY, CARBON DIOXIDE, REGULAR FOAM, OR DRY CHEMICAL. *
Special Fire Fighting Proc: MOVE CONTAINERS FROM AREA IF W/O RISK. COOL CONTAINER W/WATER. STAY AWAY FROM ENDS OF TANKS. FOR MASSIVE FIRE,USE UNMANNED HOSE HOLDERS OR WITHDRAW AND LET BURN *
Unusual Fire And Expl Hazrds: WITHDRAW IMMEDIATELY IF CONTAINER IS VENTING, OR DISCOLORED. USE WATER IN FLOODING AMOUNTS AS A FOG. STREAM MAY SPREAD FIRE. AVOID BREATHING HAZARDOUS MATERIAL. *

Reactivity Data

Stability: YES *
Cond To Avoid (Stability): AVOID CONTACT WITH HEAT, SPARKS, FLAMES AND OTHER SOURCES OF IGNITION *
Materials To Avoid: ACIDS, CHLORINE, NITRIC ACID, PERCHLORATES, URANIUM HEXAFLUORIDE *
Hazardous Decomp Products: THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE OXIDES OF CARBON. *
Hazardous Poly Occur: NO *
Conditions To Avoid (Poly): NOT RELEVANT *

Health Hazard Data

LD50-LC50 Mixture: ORAL RAT LD50: UNKNOWN *
Route Of Entry - Inhalation: YES *
Route Of Entry - Skin: YES *
Route Of Entry - Ingestion: YES *
Health Haz Acute And Chronic: TARGET EFFECTS: CNS DEPRESSANT. BONE MARROW DEPRESSANT. MAY AFFECT IMMUNE SYSTEM AND HEART. LOCAL EFFECTS: RESPIRATORY IRRITATION, PULMONARY EDEMA, HEADACHE,DIZZINESS, WEAKNESS. DEATH DUE TO ASPHYXIA. CNS DEPRESSION, CARDIAC OR RESPIRATORY FAILURE. *
Carcinogenicity - NTP: YES *
Carcinogenicity - IARC: YES *
Carcinogenicity - OSHA: YES *
Explanation Carcinogenicity: CONTAINS BENZENE [71-43-2] WHICH IS LISTED BY NTP AND IARC AND REGULATED BY OSHA AS A CARCINOGEN (CAUSES LEUKEMIA.) *
Signs/Symptoms Of Overexp: DEATH FROM CIRCULATORY COLLAPSE & VENTRICULAR FIBRILLATION. CHRONIC: INHALATION: SYMPTOMS OF CNS HEMATOPIETIC & IMMUNE SYSTEMS. SKIN: BURNS, BLISTERS, EDEMA. CHRONIC:CONJUNCTIVITIS. INGESTION:NAUSEA VOMITING, SHALLOW RESPIRATION, DEATH FROM 10-15 ML. SINGLE EXPOSURE:LONG TERM EFFECTS POSSIBLY W/PANCYTOPENIA PERSISTING *
Med Cond Aggravated By Exp: PERSONS W/CERTAIN IMMUNOLOGICAL TENDENCIES, POOR NUTRITION, ANEMIA, DRUG OR CHEMICALLY INDUCED AGRANULOCYTEMIA. *
Emergency/First Aid Proc: EYE: FLUSH W/WATER OR NORMAL SALINE, 15 MIN, HOLD LIDS OPEN. SKIN: WASH WITH SOAP & WATER. REMOVE CONTAMINATED CLOTHING AND LAUNDER BEFORE REUSE. INHALATION: REMOVE TO FRESH AIR. AID/RESTORE BREATHING IF NECESSARY. INGESTED: DO NOT INDUCE VOMITING. PREVENT ASPIRATION. GET IMMEDIATE MEDICAL CARE. *

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: ELIMINATE IGNITION SOURCES. USE WATER TO REDUCE VAPORS. TAKE UP WITH SAND OR OTHER ABSORBENT MATERIAL. PLACE INTO CONTAINERS FOR DISPOSAL. SOIL SPILL: DIG HOLDING AREA. PREVENT IGNITION. WATER SPILL: APPLY DETERGENTS, SOAPS, ALCOHOLS, TO THE SPILL *
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER. *
Waste Disposal Method: USE DREDGES TO EXTRACT IMMOBILIZED MASSES OF POLLUTION. OBSERVE ALL FEDERAL, STATE & LOCAL REGULATIONS WHEN STORING AND DISPOSING OF THIS SUBSTANCE. CONTACT THE "EPA". *
Precautions-Handling/Storing: STORE IN CONTAINERS MEETING NFPA 77-1983. PROTECT FROM DAMAGE. OUTSIDE STORAGE IS PREFERRABLE. INSIDE STORAGE SHOULD BE IN FLAMM. LIQUID STORAGE ROOM *
Other Precautions: VAPORS MAY BE EXPLOSIVE. CONTAINERS MAY VIOLENTLY RUPTURE IN HEAT OR FIRE. AVOID CONTAMINATION OF WATER SOURCES. *

Control Measures

Respiratory Protection: BASED ON CONTAMINATION LEVELS IN THE WORK PLACE. FOR EXAMPLE 1/2 MASK PURIFYING RESPIRATOR W/ORGANIC VAPOR CARTRIDGE. SUPPLIED AIR RESPIRATOR OPERATED IN CONTINUOUS FLOW MODE. *
Ventilation: VENTILATION SHOULD MEET THE REQUIREMENTS SET FORTH IN 29CFR1910.1028(F). *
Protective Gloves: IMPERVIOUS GLOVES *
Eye Protection: SPLASH PROOF - DUST RESISTANT GOGGLES *
Other Protective Equipment: IMPERVIOUS CLOTHING. *
Work Hygienic Practices: EYE WASH STATION AND SAFETY SHOWER, *
Suppl. Safety & Health Data: NONE *

DOD Hazardous Materials Information System
DoD 6050.5-LR
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FSC: 6810
NIIN: 00N014236
Manufacturer's CAGE: 60928
Part No. Indicator: A
Part Number/Trade Name: CARBON TETRACHLORIDE, 99% 27065-2

General Information

Item Name:
Manufacturer's Name: ALDRICH CHEMICAL CO
Manufacturer's Street:
Manufacturer's P. O. Box: 355
Manufacturer's City: MILWAUKEE
Manufacturer's State: WI
Manufacturer's Country: US
Manufacturer's Zip Code: 53201
Manufacturer's Emerg Ph #:
Manufacturer's Info Ph #: 414-273-3850
Distributor/Vendor # 1:
Distributor/Vendor # 1 Cage:
Distributor/Vendor # 2:
Distributor/Vendor # 2 Cage:
Distributor/Vendor # 3:
Distributor/Vendor # 3 Cage:
stributor/Vendor # 4:
Distributor/Vendor # 4 Cage:
Safety Data Action Code:
Safety Focal Point: N
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 24JAN90
Safety Data Review Date: 08MAR91
Supply Item Manager:
MSDS Preparer's Name:
Preparer's Company:
Preparer's St Or P. O. Box:
Preparer's City:
Preparer's State:
Preparer's Zip Code:
Other MSDS Number:
MSDS Serial Number: BKKWC
Specification Number:
Spec Type, Grade, Class:
Hazard Characteristic Code: N/
Unit Of Issue:
Unit Of Issue Container Qty:
Type Of Container:
Net Unit Weight:
NRC/State License Number:
Net Explosive Weight:
Net Propellant Weight-Ammo:
Coast Guard Ammunition Code:

Ingredients/Identity Information

Proprietary: NO
Ingredient: CARBON TETRACHLORIDE (SARA III)
Ingredient Sequence Number: 01
Percent: N/K
Ingredient Action Code:
Ingredient Focal Point: N
NIOSH (RTECS) Number: FG4900000
CAS Number: 56-23-5
OSHA PEL: 10 PPM
ACGIH TLV: S,5PPM/10 STEL,A3 93
Other Recommended Limit: N/K

Physical/Chemical Characteristics

Appearance And Odor: COLORLESS LIQUID WITH A SWEETISH, CHLOROFORM-LIKE ODOR (FP N).
Boiling Point: 171F,77C
Melting Point: -9F,-23C
Vapor Pressure (MM Hg/70 F): 91 @ 20C
Vapor Density (Air=1): 5.32
Specific Gravity: 1.594
Decomposition Temperature: N/K
Evaporation Rate And Ref: 12.8 (BUTYL ACETATE=1)
Solubility In Water: VERY LOW
Percent Volatiles By Volume: N/K
Viscosity:
pH: N/A
Radioactivity:
Form (Radioactive Matl):
Magnetism (Milligauss):
Corrosion Rate (IPY): N/K
Autoignition Temperature:

Fire and Explosion Hazard Data

Flash Point: NONCOMBUSTIBLE
Flash Point Method: N/A
Lower Explosive Limit: N/A
Upper Explosive Limit: N/A
Extinguishing Media: USE EXTINGUISHING MEDIA APPROPRIATE TO SURROUNDING FIRE CONDITIONS.
Special Fire Fighting Proc: WEAR NIOSH/MSHA APPROVED PRESSURE DEMAND SCBA AND FULL PROTECTIVE EQUIPMENT TO PREVENT CONTACT WITH SKIN AND EYES.
Unusual Fire And Expl Hazrds: EMITS TOXIC FUMES UNDER FIRE CONDITIONS. THERMAL DECOMP PRODUCTS MAY INCLUDE HCL AND PHOSGENE (FP N).

Reactivity Data

Stability: YES
Cond To Avoid (Stability): NONE SPECIFIED BY MANUFACTURER.
Materials To Avoid: ALKALI METALS, FINELY POWDERED METALS, OXIDIZING AGENTS.
Hazardous Decomp Products: TOXIC FUMES OF: PHOSGENE GAS, CO, CO*2. HCL (FP N).

Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT

Health Hazard Data

LD50-LC50 Mixture: SEE SUPP DATA
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: ACUTE: HARMFUL IF SWALLOWED, INHALED OR ABSORBED THRU SKIN. VAP/MIST IS IRRITATING TO EYES, MUC MEMBS & UPPER RESP TRACT. CAUSES SKIN IRRIT. EXPOS CAN CAUSE: STOM PAINS, VOMIT, DIARR, NAUS, DIZZ & HDCH, DMG TO EYES, LIVER & KIDNEYS. EXPOSURE TO AND/OR CONSUMPTION OF ALCOHOL MAY INCREASE TOX EFTS. (SEE EFTS OF OVEREXP)
Carcinogenicity - NTP: YES
Carcinogenicity - IARC: YES
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NTP, IARC GROUP 2B.
Signs/Symptoms Of Overexp: HLTH HAZ: CHRONIC: CARCINOGEN. MAY ALTER GENETIC MATERIAL.
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
Emergency/First Aid Proc: EYES/SKIN: IMMED FLUSH W/COPIOUS AMTS OF WATER FOR AT LEAST 15 MIN WHILE REMOVING CONTAM CLOTHING & SHOES. EYE CONTAM SHOULD BE TREATED BY IMMED & PRLNG IRRIGATION W/COPIOUS AMTS OF WATER. ASSURE ADEQUATE FLUSHING OF EYES BY SEPARATING EYELIDS W/FINGERS. INHAL: REMOVE TO FRESH AIR. IF NOT BRTHG, GIVE ARTF RESP. IF BRTHG DFCLT, GIVE O*2. CALL MD. INGEST: DO NOT INDUCE VOMIT. CALL MD IMMED (FP N).

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: EVACUATE AREA. WEAR NIOSH/MSHA APPROVED SCBA, RUBBER BOOTS & HEAVY RUBBER GLOVES. COVER WITH AN ACTIVATED CARBON ABSORBENT, TAKE UP AND PLACE IN CLOSED CONTAINERS. TRANSPORT OUTDOORS.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: DISSOLVE OR MIX THE MATERIAL WITH A COMBUSTIBLE SOLVENT AND BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER. DISPOSE I/A/W FEDERAL, STATE AND LOCAL LAWS.
Precautions-Handling/Storing: CARCINOGEN. READILY ABSORBED THROUGH SKIN. DO NOT BREATHE VAP, GET IN EYES, ON SKIN OR CLOTHING. KEEP TIGHTLY CLOSED. STORE IN A COOL, DRY PLACE.
Other Precautions: TOXIC. IRRITANT. MUTAGEN. NO SMOKING IN AREA OF USE. DO NOT USE IN THE GENERAL VICINITY OF ARC WELDING, OPEN FLAMES OR HOT SURFACES. HEAT AND/OR UV RADIATION MAY CAUSE THE FORMATION OF HCL AND/OR PHOSGENE (FP N).

Control Measures

Respiratory Protection: WEAR APPROPRIATE NIOSH/MSHA APPROVED RESPIRATOR.
Ventilation: USE ONLY IN A CHEMICAL FUME HOOD.
Protective Gloves: CHEMICAL-RESISTANT GLOVES
Eye Protection: CHEMICAL WORKERS GOGGLES (FP N)
Other Protective Equipment: RUBBER BOOTS AND OTHER PROTECTIVE CLOTHING, SAFETY SHOWER AND EYE BATH
Work Hygienic Practices: WASH HANDS THOROUGHLY AFTER USE AND BEFORE EATING, DRINKING, SMOKING OR USING SANITARY FACILITIES (FP N).
Suppl. Safety & Health Data: LD50-LC50 MIX: LD50: (ORAL/RAT)=2350 MG/KG, (SKIN/RAT)=5070 MG/KG, (IPR/RAT)=1500 MG/KG, (ORAL/MUS)=8263 MG/KG, (IPR/

MUS)=572 MG/KG, (SCU/MUS)=31 GM/KG, (IPR/DOG)=1500 MG/KG, (ORAL/RBT)=5760 MG/KG, (IVN/RBT)=5840 MG/KG, (ORAL/GPG)=5760 MG/KG, (IPR/CKN)=4497 MG/KG.

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FSC: 6810
NIIN: 008257436
Manufacturer's CAGE: 9A714
Part No. Indicator: A
Part Number/Trade Name: ETHYL BENZENE, REAGENT

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General Information

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Item Name: ETHYL BENZENE REAGENT
Manufacturer's Name: NORTH STRONG, INC.
Manufacturer's Street: 7322 WESTMORE RD
Manufacturer's P. O. Box:
Manufacturer's City: ROCKVILLE
Manufacturer's State: MD
Manufacturer's Country: US
Manufacturer's Zip Code: 20850-1260
Manufacturer's Emerg Ph #:
Manufacturer's Info Ph #:
Distributor/Vendor # 1:
Distributor/Vendor # 1 Cage:
Distributor/Vendor # 2:
Distributor/Vendor # 2 Cage:
Distributor/Vendor # 3:
Distributor/Vendor # 3 Cage:
Distributor/Vendor # 4:
Distributor/Vendor # 4 Cage:
Safety Data Action Code:
Safety Focal Point: D
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status:
Date MSDS Prepared: PRE-HCS
Safety Data Review Date: 26NOV79
Supply Item Manager:
MSDS Preparer's Name:
Preparer's Company:
Preparer's St Or P. O. Box:
Preparer's City:
Preparer's State:
Preparer's Zip Code:
Other MSDS Number:
MSDS Serial Number: BFRJJ
Specification Number:
Spec Type, Grade, Class:
Hazard Characteristic Code: F3
Unit Of Issue: BT
Unit Of Issue Container Qty: 1 KG
Type Of Container:
Net Unit Weight:
NRC/State License Number:
Net Explosive Weight:
Net Propellant Weight-Ammo:
Coast Guard Ammunition Code:

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Ingredients/Identity Information

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Proprietary: NO
Ingredient: ETHYL BENZENE (SARA III)
Ingredient Sequence Number: 01
Percent:
Ingredient Action Code:
Ingredient Focal Point: D
NIOSH (RTECS) Number: DA0700000
CAS Number: 100-41-4
OSHA PEL: 100 PPM/125 STEL
ACGIH TLV: 100 PPM/125STEL 9192
Other Recommended Limit:

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Physical/Chemical Characteristics

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Appearance And Odor:
Boiling Point:
Melting Point:
Vapor Pressure (MM Hg/70 F):
Vapor Density (Air=1):
Specific Gravity:
Decomposition Temperature:
Evaporation Rate And Ref:
Solubility In Water:
Percent Volatiles By Volume:
Viscosity:
pH:
Radioactivity:
Form (Radioactive Matl):
Magnetism (Milligauss):
Corrosion Rate (IPY):
Autoignition Temperature:

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Fire and Explosion Hazard Data

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Flash Point:
Flash Point Method:
Lower Explosive Limit:
Upper Explosive Limit:
Extinguishing Media:
Special Fire Fighting Proc:
Unusual Fire And Expl Hazrds:

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Reactivity Data

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Stability:
Cond To Avoid (Stability):
Materials To Avoid:
Hazardous Decomp Products:
Hazardous Poly Occur:
Conditions To Avoid (Poly):

Health Hazard Data

LD50-LC50 Mixture:
Route Of Entry - Inhalation:
Route Of Entry - Skin:
Route Of Entry - Ingestion:
Health Haz Acute And Chronic:
Carcinogenicity - NTP:
Carcinogenicity - IARC:
Carcinogenicity - OSHA:
Explanation Carcinogenicity:
Signs/Symptoms Of Overexp:
Med Cond Aggravated By Exp:
Emergency/First Aid Proc:

Precautions for Safe Handling and Use

Steps If Matl Released/Spill:
Neutralizing Agent:
Waste Disposal Method:
Precautions-Handling/Storing:
Other Precautions:

Control Measures

Respiratory Protection:
Ventilation:
Protective Gloves:
Eye Protection:
Other Protective Equipment:
Work Hygienic Practices:
Suppl. Safety & Health Data:

DOD Hazardous Materials Information System
DoD 6050.5-LR
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FSC: 9150
NIIN: 00B010044
Manufacturer's CAGE: 15958
Part No. Indicator: A
Part Number/Trade Name: NO.2 DIESEL FUEL

General Information

Item Name: N/K
Manufacturer's Name: AMOCO OIL COMPANY
Manufacturer's Street: 200 EAST RANDOLPH DRIVE
Manufacturer's P. O. Box:
Manufacturer's City: CHICAGO
Manufacturer's State: IL
Manufacturer's Country: US
Manufacturer's Zip Code: 60601
Manufacturer's Emerg Ph #: 800 447-8735
Manufacturer's Info Ph #: 312 856-3907
Distributor/Vendor # 1: N/K
Distributor/Vendor # 1 Cage: N/K
Distributor/Vendor # 2: N/K
Distributor/Vendor # 2 Cage: N/K
Distributor/Vendor # 3: N/K
Distributor/Vendor # 3 Cage: N/K
Distributor/Vendor # 4: N/K
Distributor/Vendor # 4 Cage: N/K
Safety Data Action Code:
Safety Focal Point: B
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: N/K
Date MSDS Prepared:
Safety Data Review Date: 04FEB88
Supply Item Manager: N/K
MSDS Preparer's Name: N/K
Preparer's Company: N/K
Preparer's St Or P. O. Box: N/K
Preparer's City: N/K
Preparer's State:
Preparer's Zip Code: N/K
Other MSDS Number:
MSDS Serial Number: BBBDD
Specification Number: N/K
Spec Type, Grade, Class: N/K
Hazard Characteristic Code:
Unit Of Issue:
Unit Of Issue Container Qty:
Type Of Container:
Net Unit Weight:
NRC/State License Number: N/K
Net Explosive Weight:
Net Propellant Weight-Ammo: N/K
Coast Guard Ammunition Code:

Ingredients/Identity Information

Proprietary: NO
Ingredient: PETROLEUM DISTILLATES (NAPHTHA OR RUBBER SOLVENT)
Ingredient Sequence Number: 01
Percent: N/K
Ingredient Action Code:
Ingredient Focal Point: B
NIOSH (RTECS) Number: SE7449000
CAS Number: 8002-05-9
OSHA PEL: 400 PPM
ACGIH TLV: 400 PPM; 8990
Other Recommended Limit: N/K

Physical/Chemical Characteristics

Appearance And Odor: CLEAR,BRIGHT LIQUID
Boiling Point: 340F TO 675
Melting Point: N/K
Vapor Pressure (MM Hg/70 F): N/K
Vapor Density (Air=1): N/K
Specific Gravity: 0.88
Decomposition Temperature: N/K
Evaporation Rate And Ref: N/K
Solubility In Water: NEGLIGIBLE
Percent Volatiles By Volume: N/K
Viscosity:
[illegible]: N/K
Radioactivity:
Form (Radioactive Matl):
Magnetism (Milligauss):
Corrosion Rate (IPY): N/K
Autoignition Temperature:

Fire and Explosion Hazard Data

Flash Point: 120F TO 180F
Flash Point Method: TCC
Lower Explosive Limit: 0.6
Upper Explosive Limit: 7.5
Extinguishing Media: AGENTS APPROVED FOR CLASS B HAZARDS:DRY CHEMICAL, CARBON DIOXIDE,HALOGENATED AGENTS,FOAM,STEAM OR WATER FOG
Special Fire Fighting Proc: N/K
Unusual Fire And Expl Hazrds: N/K

Reactivity Data

Stability: N/K
Cond To Avoid (Stability): N/K
Materials To Avoid: N/K
Hazardous Decomp Products: N/K
Hazardous Poly Occur: N/K
Conditions To Avoid (Poly): N/K

Health Hazard Data

LD50-LC50 Mixture: N/K
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: TRY TO AVOID CONTINUAL,REPEATED CONTACT AS PROBLEMS COULD ARISE IF PROPER HYGIENE IS NOT TAKEN.
Carcinogenicity - NTP: N/K
Carcinogenicity - IARC: N/K
Carcinogenicity - OSHA: N/K
Explanation Carcinogenicity: N/K
Signs/Symptoms Of Overexp: EYE:NO SIGNIFICANT IRRITATION EXPECTED.SKIN: CAN CAUSE SKIN IRRITATION UPON PROLONGED OR REPEATED CONTACT.INHALATION: NONE EXPECTED UNDER USUAL CONDITIONS OF USE.INGESTION:LOW VISCOSITY PRODUCT.HARMFUL OR FATAL IF SWALLOWED AND/OR ASPIRATED INTO LUNGS.
Med Cond Aggravated By Exp: N/K
Emergency/First Aid Proc: EYES:FLUSH EYES WITH PLENTY OF WATER.SKIN: WASH EXPOSED SKIN WITH SOAP AND WATER.REMOVE CONTAMINATED CLOTHING, INCLUDING SHOES AND CLEAN AND DRY THOROUGHLY BEFORE USE.INHALATION:N/R. INGESTION:IF SWALLOWED DO NOT INDUCE VOMITING,GET IMMEDIATE MEDICAL ATTENTION.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: REMOVE MECHANICALLY OR CONTAIN ON ABSORBANT MATERIAL.
Neutralizing Agent: N/K
Waste Disposal Method: ENCLOSED-CONTROLLED INCINERATION UNLESS DIRECTED OTHERWISE BY APPLICABLE ORDINANCES.
Precautions-Handling/Storing: STORE AWAY FROM HEAT,IGNITION SOURCES.OPEN FLAME,IN ACCORDANCE WITH APPLICABLE REGULATIONS.
Other Precautions: AVOID STRONG OXIDIZERS.

Control Measures

Respiratory Protection: USE WITH ADEQUATE VENTILATION
Ventilation: N/K
Protective Gloves: WEAR PROTECTIVE GLOVES
Eye Protection: USE OF SAFETY GLASSES IS GOOD PRACTICE
Other Protective Equipment: N/K
Work Hygienic Practices: CLEAN UP ANY MESS AND USE GOOD PERSONAL HYGIENE
Suppl. Safety & Health Data:

DOD Hazardous Materials Information System
DoD 6050.5-LR
AS OF August 1994
Proprietary Version - For U.S. Government Use Only

FSC: 9140
NIIN: 00B030052
Manufacturer's CAGE: 58326
Part No. Indicator: A
Part Number/Trade Name: NO. 1 DIESEL FUEL/NO. 1 FUEL OIL

General Information

Item Name: N/K
Manufacturer's Name: CONOCO INC.
Manufacturer's Street: N/K
Manufacturer's P. O. Box: 2197
Manufacturer's City: HOUSTON
Manufacturer's State: TX
Manufacturer's Country: US
Manufacturer's Zip Code: 77252
Manufacturer's Emerg Ph #: 713-293-5550
Manufacturer's Info Ph #: 713-293-5550
Distributor/Vendor # 1: N/K
Distributor/Vendor # 1 Cage:
Distributor/Vendor # 2:
Distributor/Vendor # 2 Cage:
Distributor/Vendor # 3:
Distributor/Vendor # 3 Cage:
Distributor/Vendor # 4:
Distributor/Vendor # 4 Cage:
Safety Data Action Code:
Safety Focal Point: B
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status:
Date MSDS Prepared: 00DEC88
Safety Data Review Date: 14APR89
Supply Item Manager:
MSDS Preparer's Name: N/K
Preparer's Company:
Preparer's St Or P. O. Box:
Preparer's City:
Preparer's State:
Preparer's Zip Code:
Other MSDS Number:
MSDS Serial Number: BGSZJ
Specification Number:
Spec Type, Grade, Class:
Hazard Characteristic Code:
Unit Of Issue:
Unit Of Issue Container Qty:
Type Of Container:
Net Unit Weight:
NRC/State License Number:
Net Explosive Weight:
Net Propellant Weight-Ammo:
Coast Guard Ammunition Code:

Ingredients/Identity Information

Proprietary: NO
Ingredient: HYDROCARBONS (AROMATIC & PARAFFINIC)
Ingredient Sequence Number: 01
Percent: >90
Ingredient Action Code:
Ingredient Focal Point: B
NIOSH (RTECS) Number: 1000007AH
CAS Number: N/K
OSHA PEL: N/K
ACGIH TLV: N/K
Other Recommended Limit: N/K

Proprietary: NO
Ingredient: NAPHTHALENE
Ingredient Sequence Number: 02
Percent: 3
Ingredient Action Code:
Ingredient Focal Point: B
NIOSH (RTECS) Number:
CAS Number: 91-20-3
OSHA PEL: N/K
ACGIH TLV: N/K
Other Recommended Limit: N/K

Physical/Chemical Characteristics

Appearance And Odor: CLEAR LIQUID,PARAFFINIC ODOR.
Boiling Point: 330-572F
Melting Point: N/K
Vapor Pressure (MM Hg/70 F): 2MMHG
Vapor Density (Air=1): >1 AIR=1
Specific Gravity: 0.81 H2O=1
Decomposition Temperature: N/K
Evaporation Rate And Ref: N/K
Solubility In Water: INSOLUBLE
Percent Volatiles By Volume: NIL
Viscosity:
pH: N/K
Radioactivity:
Form (Radioactive Matl):
Magnetism (Milligauss):
Corrosion Rate (IPY): N/K
Autoignition Temperature:

Fire and Explosion Hazard Data

Flash Point: 115F
Flash Point Method: TCC
Lower Explosive Limit: .5
Upper Explosive Limit: 6
Extinguishing Media: USE WATER SPRAY,DRY CHEMICAL,CO2,FOAM.
Special Fire Fighting Proc: USE WATER TO KEEP FIRE-EXPOSED CONTAINERS COOL. IF LEAK OR SPILL HAS NOT IGNITED,USE WATER SPRAY TO DISPERSE VAPORS AND COOL INDIVIDUALS TRYING TO STOP LEAK.

Unusual Fire And Expl Hazrds: PRODUCTS OF COMBUSTION MAY CONTAIN CO2, CARBON MONOXIDE AND OTHER TOXIC MATERIALS. DO NOT ENTER ENCLOSED OR ONFINED SPACE WITHOUT PROPER PPE INCLUDING RESPIRAT

Reactivity Data

Stability: YES
Cond To Avoid (Stability): HEAT FLAME.
Materials To Avoid: OXIDIZING MATERIALS.
Hazardous Decomp Products: N/K
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): N/K

Health Hazard Data

LD50-LC50 Mixture: N/K
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: STUDIES WITH RATS & MICE HAVE SHOWN THAT SOME PETROLEUM DISTILLATES HAVE CAUSED DAMAGE OR TUMORS OF THE KIDNEYS OR LIVER. THESE STUDIES ARE INCONCLUSIVE. NAPHTHALENE IS A POTENTIAL IRRITANT TO EYES,SKIN AND LUNGS AND MAY DAMAGE THE BLOOD,EYES AND KIDNEY AFTER PROLONGED OR REPEATED EXPOSURE.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: N/K
Signs/Symptoms Of Overexp: THIS PRODUCT MAY CAUSE IRRITATION TO EYES, LUNGS OR SKIN AFTER PROLONGED OR REPEATED EXPOSURE. OVEREXPOSURE MAY CAUSE WEAKNESS,HEADACHE,NAUSEA,ETC. INCLUDING UNCONSCIOUSNESS OR CONVULSIONS DEPENDING ON DEGREE OF OVEREXPOSURE. EXTREME EXPOSURE OR ASPIRATION INTO LUNGS MAY CAUSE PNEUMONIA.
Med Cond Aggravated By Exp: MOUSE SKIN PAINTING STUDIES HAVE SHOWN THAT PETROLEUM MID-DISTILLATES CAN CAUSE SKIN CANCER IF REPEATEDLY APPLIED AND NOT WASHED OFF SKIN. WASHING WITH SOAP/WATER GREATLY REDUCES CHANCES OF CANCER.
Emergency/First Aid Proc: EYES-FLUSH IMMEDIATELY WITH PLENTY OF WATER FOR 15 MIN. IF SWALLOWED,DO NOT INDUCE VOMITING. SEEK MEDICAL ATTENTION FOR BOTH SITUATIONS. IF BREATHING STOPS,GIVE ARTIFICIAL RESPIRATION. SKIN-REMOVE CONTAMINATED CLOTHING AS SOON AS POSSIBLE. WASH EXPOSED SKIN WITH SOAP AND WATER. IF IRRITATION PERSISTS CONSULT A PHYSICIAN. NOTE TO PHYSICIAN-GASTRIC LAVAGE MAY BE CONSIDERED BASED ON QUANTITY INGESTED

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: CONTAINS SPILL IMMEDIATELY IN SMALLEST POSSIBLE AREA. RECOVER AS MUCH OF THE PRODUCT ITSELF AS POSSIBLE BY VACUUMING,THEN RECOVER RESIDUAL FLUIDS BY USING ABSORBENT MATERIAL. REMOVE CONTAMINATED ITEMS AND PLACE IN PROPER DISPOSAL CONTAINERS.
Neutralizing Agent: N/K
Waste Disposal Method: RECYCLE AS MUCH OF THE RECOVERABLE PRODUCT AS POSSIBLE. DISPOSE OF NONRECYCLABLE MATERIAL IN ACCORDANCE WITH STATE,LOCAL AND FEDERAL REGULATIONS. AVOID WASHING,DRAINING OR DIRECTING MATERIAL TO STORM OR SANITARY SEWERS.
Precautions-Handling/Storing: STORE IN ACCORDANCE WITH NFPA REGULATIONS.
Other Precautions: CONTACT CONOCO FOR MORE INFORMATION.

Control Measures

Respiratory Protection: SELECT APPROPRIATE NIOSH APPROVED RESPIRATORY PROTECTION WHERE NECESSARY TO MAINTAIN EXPOSURES BELOW THE ACCEPTABLE LIMITS. PROPER RESPIRATOR SHOULD BE DETERMINED BY ADEQUATELY TRAINED PERSONNEL.
Ventilation: USE SUFFICIENT VENTILATION TO MAINTAIN ATMOSPHERIC CONCENTRATIONS BELOW PERMISSIBLE EXPOSURE LIMITS. AVOID SPARKING MIX.
Protective Gloves: NBR OR NEOPRENE FOR PROLONGED SKIN EXPOS
Eye Protection: SPLASH GOGGLES OR FACE SHIELD FOR SPRAY.
Other Protective Equipment: SUFFICIENT PROTECTIVE CLOTHING TO MINIMIZE SKIN EXPOSURE. LAUNDER CONTAMINATED CLOTHING BEFORE REUSE.
Work Hygienic Practices: AVOID CONTACT WITH EYES,SKIN OR CLOTHING. WASH WITH SOAP AND WATER IF SKIN CONTACT OCCURS.
Suppl. Safety & Health Data: WATER SPRAY MAY BE USED TO FLUSH SPILLS AWAY FROM EXPOSURES. HANDLE AND STORE IN ACCORDANCE WITH NFPA PROCEDURES.

DOD Hazardous Materials Information System
DoD 6050.5-LR
AS OF August 1994
Proprietary Version - For U.S. Government Use Only

FSC: 9130
NIIN: 001487102
Manufacturer's CAGE: 6Y142
Part No. Indicator: A
Part Number/Trade Name: GASOLINES (ALL GRADES)

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General Information

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Item Name: GASOLINE,AUTOMOTIVE,SPECIAL GRADE MOGAS UNLEADED
Manufacturer's Name: PHILLIPS 66 CO.
Manufacturer's Street: 346 HOME SAVINGS AND LOAN BLDG
Manufacturer's P. O. Box:
Manufacturer's City: BARTLESVILLE
Manufacturer's State: OK
Manufacturer's Country: US
Manufacturer's Zip Code: 74004
Manufacturer's Emerg Ph #: 918-661-3865 OR 918-661-8118
Manufacturer's Info Ph #: 918-661-8327
Distributor/Vendor # 1:
Distributor/Vendor # 1 Cage:
Distributor/Vendor # 2:
Distributor/Vendor # 2 Cage:
Distributor/Vendor # 3:
Distributor/Vendor # 3 Cage:
stributor/Vendor # 4:
Distributor/Vendor # 4 Cage:
Safety Data Action Code:
Safety Focal Point: D
Record No. For Safety Entry: 042
Tot Safety Entries This Stk#: 049
Status: SM
Date MSDS Prepared: 31MAR90
Safety Data Review Date: 01AUG93
Supply Item Manager: KY
MSDS Preparer's Name:
Preparer's Company:
Preparer's St Or P. O. Box:
Preparer's City:
Preparer's State:
Preparer's Zip Code:
Other MSDS Number:
MSDS Serial Number: BRGRH
Specification Number: VV-G-1690
Spec Type, Grade, Class: SPECIAL GRADE
Hazard Characteristic Code: F2
Unit Of Issue: GL
Unit Of Issue Container Qty: BULK
Type Of Container: TANK
Net Unit Weight: UNKNOWN
C/State License Number: NONE
c Explosive Weight:
Net Propellant Weight-Ammo: NONE
Coast Guard Ammunition Code:

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Ingredients/Identity Information
==
Proprietary: NO
Ingredient: GASOLINE
Ingredient Sequence Number: 01
Percent: 100
Ingredient Action Code:
Ingredient Focal Point: D
NIOSH (RTECS) Number: LX3300000
CAS Number: 8006-61-9
OSHA PEL: 300 PPM/500 STEL
ACGIH TLV: 300 PPM/500STEL;9192
Other Recommended Limit: NONE SPECIFIED

Proprietary: NO
Ingredient: BENZENE (SARA III)
Ingredient Sequence Number: 02
Percent: <5
Ingredient Action Code:
Ingredient Focal Point: D
NIOSH (RTECS) Number: CY1400000
CAS Number: 71-43-2
OSHA PEL: 1PPM/5STEL;1910.1028
ACGIH TLV: 10 PPM; A2; 9192
Other Recommended Limit: NONE SPECIFIED

Proprietary: NO
Ingredient: TOLUENE (SARA III)
Ingredient Sequence Number: 03
Percent: <10
Ingredient Action Code:
Ingredient Focal Point: D
NIOSH (RTECS) Number: XS5250000
CAS Number: 108-88-3
OSHA PEL: 200 PPM/150 STEL
ACGIH TLV: 50 PPM; 9293
Other Recommended Limit: NONE SPECIFIED

Proprietary: NO
Ingredient: ETHYL BENZENE (SARA III)
Ingredient Sequence Number: 04
Percent: <2
Ingredient Action Code:
Ingredient Focal Point: D
NIOSH (RTECS) Number: DA0700000
CAS Number: 100-41-4
OSHA PEL: 100 PPM/125 STEL
ACGIH TLV: 100 PPM/125STEL 9192
Other Recommended Limit: NONE SPECIFIED

Proprietary: NO
Ingredient: P-XYLENE (P-DIMETHYLBENZENE) (SARA III)
Ingredient Sequence Number: 05
Percent: <3
Ingredient Action Code:
Ingredient Focal Point: D

NIOSH (RTECS) Number: ZE2625000
CAS Number: 106-42-3
HA PEL: 100 PPM/150 STEL
GIH TLV: 100 PPM/150STEL;9192
Other Recommended Limit: NONE SPECIFIED

Proprietary: NO
Ingredient: M-XYLENE (M-DIMETHYLBENZENE) (SARA III)
Ingredient Sequence Number: 06
Percent: <6
Ingredient Action Code:
Ingredient Focal Point: D
NIOSH (RTECS) Number: ZE2275000
CAS Number: 108-38-3
OSHA PEL: 100 PPM/150 STEL
ACGIH TLV: 100 PPM/150STEL;9192
Other Recommended Limit: NONE SPECIFIED

Proprietary: NO
Ingredient: O-XYLENE (O-DIMETHYLBENZENE) (SARA III)
Ingredient Sequence Number: 07
Percent: <3
Ingredient Action Code:
Ingredient Focal Point: D
NIOSH (RTECS) Number: ZE2450000
CAS Number: 95-47-6
OSHA PEL: 100PPM/150 STEL
ACGIH TLV: 100 PPM/150STEL;9192
her Recommended Limit: NONE SPECIFIED

Proprietary: NO
Ingredient: METHYL TERT-BUTYL ETHER (SARA III)
Ingredient Sequence Number: 08
Percent: <15
Ingredient Action Code:
Ingredient Focal Point: D
NIOSH (RTECS) Number: KN5250000
CAS Number: 1634-04-4
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE SPECIFIED

Proprietary: NO
Ingredient: 1,2,4-TRIMETHYLBENZENE (SARA III)
Ingredient Sequence Number: 09
Percent: <3
Ingredient Action Code:
Ingredient Focal Point: D
NIOSH (RTECS) Number: DC3325000
CAS Number: 95-63-6
OSHA PEL: 25 PPM
ACGIH TLV: 25 PPM; 9192
Other Recommended Limit: NONE SPECIFIED

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Physical/Chemical Characteristics

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Appearance And Odor: RED-ORANGE LIQUID. PUNGENT ODOR.
Boiling Point: 80.0F,26.7C
Melting Point: UNKNOWN
Vapor Pressure (MM Hg/70 F): 350-800 MM
Vapor Density (Air=1): 3-4
Specific Gravity: 0.8
Decomposition Temperature: UNKNOWN
Evaporation Rate And Ref: >1 (BUTYL ACETATE = 1)
Solubility In Water: NEGLIGIBLE
Percent Volatiles By Volume: 100
Viscosity: UNKNOWN
pH: N/K
Radioactivity:
Form (Radioactive Matl):
Magnetism (Milligauss):
Corrosion Rate (IPY): UNKNOWN
Autoignition Temperature: N/K

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Fire and Explosion Hazard Data

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Flash Point: <-35F,<-37C
Flash Point Method: ESTIM.
Lower Explosive Limit: 1.5
Upper Explosive Limit: 7.6
Extinguishing Media: USE CARBON DIOXIDE, FOAM, OR DRY CHEMICAL.
Special Fire Fighting Proc: WEAR FIRE FIGHTING PROTECTIVE EQUIPMENT AND A FULL FACED SELF CONTAINED BREATHING APPARATUS. EVACUATE AREA. COOL FIRE EXPOSED CONTAINERS WITH WATER SPRAY.
Unusual Fire And Expl Hazrds: COMBUSTION OR HEAT OF FIRE MAY PRODUCE HAZARDOUS DECOMPOSITION PRODUCTS AND VAPORS. VAPORS HEAVIER THAN AIR.MAY TRAVEL ALONG GROUND AND FLASHBACK.

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Reactivity Data

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Stability: YES
Cond To Avoid (Stability): MFR: "N/A" HMIS:HIGH HEAT, OPEN FLAMES AND OTHER SOURCES OF IGNITION
Materials To Avoid: OXYGEN AND STRONG OXIDIZING AGENTS.
Hazardous Decomp Products: CARBON OXIDES, AND VARIOUS HYDROCARBONS WHEN BURNED.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT APPLICABLE

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Health Hazard Data

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LD50-LC50 Mixture: LD50 ORAL RAT IS UNKNOWN
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: ACUTE: IRRITATION, CENTRAL NERVOUS SYSTEM EFFECTS. GASOLINE IF SWALLOWED, MAY BE ASPIRATED INTO LUNGS, RESULTING IN PULMONARY EDEMA AND CHEMICAL PNEUMONITIS. CHRONIC:HAS PRODUCED KIDNEY DAMAGE IN RATS. NOT KNOWN TO OCCUR IN HUMANS.
Carcinogenicity - NTP: YES

Carcinogenicity - IARC: YES
Carcinogenicity - OSHA: YES
Explanation Carcinogenicity: UNLEADED GASOLINE HAS PRODUCED CANCER IN ANIMALS. NO COMPARABLE HEALTH HAZARD FOR CANCER IS KNOWN TO OCCUR IN HUMANS.
Signs/Symptoms Of Overexp: EYES/SKIN: SLIGHT IRRITATION. INHALATION: HEADACHE, NAUSEA, WEAKNESS, SEDATION, AND UNCONSCIOUSNESS. INGESTION: IRRITATION TO INTESTINES. ASPIRATION INTO LUNG AFTER INGESTION MAY RESULT IN PULMONARY EDEMA AND CHEMICAL PNEUMONITIS.
Med Cond Aggravated By Exp: NO INFORMATION GIVEN ON MSDS BY MFR.
Emergency/First Aid Proc: IF IRRITATION PERSISTS OR IS SEVERE, SEE A DOCTOR. EYE:FLUSH W/WATER 15 MIN. SKIN:WASH WITH SOAP & WATER. (HMIS: REMOVE CONTAMINATED CLOTHING AND LAUNDER BEFORE REUSE.) INHALED:REMOVE TO FRESH AIR. AID/RESTORE BREATHING IF NECESSARY. INGESTED:DO NOT INDUCE VOMITING; GET IMMEDIATE MEDICAL CARE. **NOTE TO PHYSICIAN:GASTRIC LAVAGE WITH A CUFFED ENDOTRACHEAL TUBE MAY BE USED AT YOUR DISCRETION.

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Precautions for Safe Handling and Use

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Steps If Matl Released/Spill: EVACUATE AREA. WEAR APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT. ELIMINATE IGNITION SOURCES. SHUT OFF LEAK & CONTAIN SPILL. PROTECT FROM IGNITION. KEEP OUT OF WATER SOURCES & SEWERS. ABSORB ON DRY INERT MATERIAL. TRANSFER TO DRUMS WITH NON-SPARK TOOLS.
Neutralizing Agent: NO INFORMATION GIVEN ON MSDS BY MFR.
Waste Disposal Method: INCINERATE OR OTHERWISE MANAGE IN A RERA PERMITTED WASTE MANAGEMENT FACILITY.
Precautions-Handling/Storing: STORE IN COOL,WELL VENTED AREA, AWAY FROM IGNITION SOURCES. KEEP CONTAINERS CLOSED & PROTECT FROM PHYSICAL DAMAGE. GROUND CONTAINERS DURING TRANSFER.
Other Precautions: PROVIDE MEANS TO CONTROL LEAKS. AVOID BREATHING VAPORS. AVOID EYE, SKIN, CLOTHING CONTACT. DO NOT SIPHON BY MOUTH. LAUNDER CONTAMINATED CLOTHING BEFORE REUSE. WEAR PROTECTIVE EQUIPMENT WHEN CONDITIONS WARRENT. WASH THOROUGHLY AFTER HANDLING

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Control Measures

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Respiratory Protection: FOR CONCENTRATIONS EXCEEDING THE RECOMMENDED LEVEL, USE NIOSH/MSHA APPROVED AIR PUIFYING RESPIRATOR. USE SCBA FOR EXPOSURE TO UNKNOWN LEVELS.
Ventilation: USE ADEQUATE VENTILATION TO CONTROL EXPOSURE BELOW RECOMMENDED LEVELS.
Protective Gloves: VITON, NITRILE, PVA.
Eye Protection: SAFETY GLASSES WITH SIDE SHIELDS.
Other Protective Equipment: FULL BODY LONG-SLEEVED GARMENTS TO PREVENT REPEATED OR PROLONGED SKIN CONTACT. HMIS: EYE WASH STATION AND SAFETY SHOWER.
Work Hygienic Practices: MFR: ? HMIS:USE GOOD INDUSTRIAL HYGIENE PRACTICE. AVOID UNNECESSARY CONTACT. WASH THOROUGHLY BEFORE EATING OR DRINKING.
Suppl. Safety & Health Data: KEY2:KT NOTE:MFR SUPPLIED ONE MSDS FOR BOTH LEADED AND UNLEADED GASOLINES. HMIS DELETED REFERENCES TO LEAD FROM THOSE FOR "UNLEADED" GASOLINE

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FSC: 6830
NIIN: 00N047659
Manufacturer's CAGE: 51847
Part No. Indicator: A
Part Number/Trade Name: HYDROGEN SULFIDE

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General Information

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Item Name:
Manufacturer's Name: SCOTT SPECIALTY GASES, INC
Manufacturer's Street: ROUTE 611
Manufacturer's P. O. Box:
Manufacturer's City: PLUMSTEADVILLE
Manufacturer's State: PA
Manufacturer's Country: US
Manufacturer's Zip Code: 18949
Manufacturer's Emerg Ph #: 215-766-8861
Manufacturer's Info Ph #: 215-766-8861
Distributor/Vendor # 1:
Distributor/Vendor # 1 Cage:
Distributor/Vendor # 2:
Distributor/Vendor # 2 Cage:
Distributor/Vendor # 3:
Distributor/Vendor # 3 Cage:
Distributor/Vendor # 4:
Distributor/Vendor # 4 Cage:
Safety Data Action Code:
Safety Focal Point: N
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 05DEC90
Safety Data Review Date: 18JAN94
Supply Item Manager:
MSDS Preparer's Name:
Preparer's Company:
Preparer's St Or P. O. Box:
Preparer's City:
Preparer's State:
Preparer's Zip Code:
Other MSDS Number:
MSDS Serial Number: BSKSD
Specification Number:
Spec Type, Grade, Class:
Hazard Characteristic Code: NK
Unit Of Issue:
Unit Of Issue Container Qty:
Type Of Container:
Net Unit Weight:
NRC/State License Number:
Net Explosive Weight:
Net Propellant Weight-Ammo:
Coast Guard Ammunition Code:

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Ingredients/Identity Information
==
Proprietary: NO
Ingredient: HYDROGEN SULFIDE
Ingredient Sequence Number: 01
Percent: >99
Ingredient Action Code:
Ingredient Focal Point: N
NIOSH (RTECS) Number: MX1225000
CAS Number: 7783-06-4
OSHA PEL: 20 PPM, C
ACGIH TLV: 10 PPM;15 STEL
Other Recommended Limit: N/K
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Physical/Chemical Characteristics
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Appearance And Odor: COLORLESS GAS WITH AN OFFENSIVE, ROTTEN EGG ODOR
Boiling Point: -77F,-60C
Melting Point: N/K
Vapor Pressure (MM Hg/70 F): 18.15@20C
Vapor Density (Air=1): 1.19@25C
Specific Gravity: SUPP DATA
Decomposition Temperature: N/K
Evaporation Rate And Ref: NOT APPLICABLE
Solubility In Water: 2.26 ML/1ML OF H*2O
Percent Volatiles By Volume: 100
Viscosity:
: N/K
Radioactivity:
Form (Radioactive Matl):
Magnetism (Milligauss):
Corrosion Rate (IPY): N/K
Autoignition Temperature:
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Fire and Explosion Hazard Data
==
Flash Point: -76F,-60C
Flash Point Method: N/K
Lower Explosive Limit: 4.3%
Upper Explosive Limit: 46%
Extinguishing Media: CO*2, DRY CHEM. THE ONLY SAFE WAY TO EXTINGUISH A H*2S FIRE IS TO STOP FLOW OF GAS.
Special Fire Fighting Proc: NIOSH/MSHA APPRVD SCBA & FULL PROT EQUIP(FP N).USE WATER SPRAY TO KEEP FIRE EXPOSED CYLINDERS COOL. TRY TO STOP FLOW OF GAS.OTHERWISE, LET FIRE BURN ITSELF OUT.
Unusual Fire And Expl Hazrds: VAP MAY TRAVEL CONSIDERABLE DISTANCE TO SOURCE OF IGNIT & FLASH BACK. EMITS TOXIC FUMES UNDER FIRE CNDTNS. CYLINDERS EXPOSED TO FIRE MAY EXPLODE. FIGHT (SUPDAT)
==
Reactivity Data
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Stability: YES
Cond To Avoid (Stability): NONE SPECIFIED BY MANUFACTURER.
Materials To Avoid: OXIDIZING MATERIALS, RUBBER, LEAD, SILVER, ALKALI METALS, MERCURY, BRASS, COPPER.
Hazardous Decomp Products: SULFUR OXIDES.

Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT

Health Hazard Data

LD50-LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: NO
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: ACUTE: IRRIT TO EYES, MUC MEMB, & UPPER RESP TRACT. MAY CAUSE PULM EDEMA, HDCH, DIZZ, BRONCHITIS, & RESP PARALYSIS. HIGH CONC MAY CAUSE COLLAPSE & DEATH. CHRONIC: MAY CAUSE CONJUNCTIVITIS, PHOTOPHOBIA, CORNEAL BULLAE, TEARING, PAIN AND BLURRED VISION.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NOT RELEVANT
Signs/Symptoms Of Overexp: SEE HEALTH HAZARDS.
Med Cond Aggravated By Exp: PERSONS W/IMPAIRED PULMONARY FUNCTION OR PRE-EXISTING EYE PROBLEMS MAY BE AT INCREASED RISK FROM EXPOSURE.
Emergency/First Aid Proc: INHAL: IMMED REMOVE TO FRESH AIR. IF BRTHG HAS STOPPED, GIVE ARTF RESP. IF BRTHG IS DFCLT, GIVE OXYGEN. SKIN: IMMED FLUSH WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMD CLTHG. CONTACT A PHYS. EYE: IMMED FLUSH WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES. CONTACT A PHYSICIAN. INGEST: CALL MD IMMED (FP N).

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: EVACUATE AND VENTILATE AREA. REMOVE SOURCES OF IGNITION. WEAR PROTECTIVE EQUIPMENT. REMOVE LEAKING CYLINDER TO EXHAUST HOOD/SAFE OUTDOORS AREA IF IT THIS CAN BE DONE SAFELY.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: RETURN CYLINDERS TO SUPPLIER FOR PROPER DISPOSAL WITH ANY VALVE OUTLET PLUGS/CAPS SECURED AND VALVE PROTECTION CAP IN PLACE. DISPOSE OF I/A/W FEDERAL, STATE AND LOCAL REGULATIONS (FP N).
Precautions-Handling/Storing: STORE IN WELL VENTD AREAS ONLY. KEEP VALVE PROT CAP ON CYLINDERS WHEN NOT IN USE & SECURE CYLINDER WHEN USING TO PROTECT FROM FALLING.
Other Precautions: USE SUITABLE HAND TRUCK TO MOVE CYLINDERS. DO NOT DEFACE CYLINDERS/LBLS. MOVE CYLINDER W/ADEQ HAND TRUCK. CYLINDERS SHOULD BE REFILLED BY QUALIFIED PRODUCERS OF COMPRESSED GASES. SHIPMENT OF A COMPRESSED GAS CYLINDER WHICH HAS (SUPP DATA)

Control Measures

Respiratory Protection: USE A NIOSH/MSHA APPROVED SCBA IN CASE OF EMERGENCY OR NON-ROUTINE USE.
Ventilation: PROVIDE ADEQUATE AND LOCAL EXHAUST VENTILATION TO MAINTAIN CONCENTRATION BELOW EXPOSURE LIMITS.
Protective Gloves: IMPERVIOUS GLOVES (FP N).
Eye Protection: SAFETY GLASSES.
Other Protective Equipment: SAFETY SHOES WHEN HANDLING PRODUCT.
Work Hygienic Practices: NONE SPECIFIED BY MANUFACTURER.
Suppl. Safety & Health Data: SPEC GRAV: 0.960@-60.3C(H*2O=1). EXPLO HAZ: FIRE FROM MAXIMUM POSSIBLE DISTANCE. OTHER PREC: NOT BEEN FILLED BY OWNER OR W/THIS WRITTEN CONSENT IS A VIOLATION OF FEDERAL LAW (49CFR).

DOD Hazardous Materials Information System
DoD 6050.5-LR
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FSC: 9130
NIIN: 00D010001
Manufacturer's CAGE: 15958
Part No. Indicator: A
Part Number/Trade Name: JET FUEL JP-4

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General Information

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Item Name:
Manufacturer's Name: AMOCO OIL COMPANY
Manufacturer's Street: 200 EAST RANDOLPH DRIVE
Manufacturer's P. O. Box:
Manufacturer's City: CHICAGO
Manufacturer's State: IL
Manufacturer's Country: US
Manufacturer's Zip Code: 60601
Manufacturer's Emerg Ph #: 800-447-8735(CHEMTREC 800-424-9300)
Manufacturer's Info Ph #: 312-856-3907
Distributor/Vendor # 1:
Distributor/Vendor # 1 Cage:
Distributor/Vendor # 2:
Distributor/Vendor # 2 Cage:
Distributor/Vendor # 3:
Distributor/Vendor # 3 Cage:
stributor/Vendor # 4:
Distributor/Vendor # 4 Cage:
Safety Data Action Code: A
Safety Focal Point: D
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SE
Date MSDS Prepared: 24SEP93
Safety Data Review Date: 15JUN94
Supply Item Manager:
MSDS Preparer's Name: DONALD M. BARKER
Preparer's Company:
Preparer's St Or P. O. Box:
Preparer's City:
Preparer's State:
Preparer's Zip Code:
Other MSDS Number:
MSDS Serial Number: BTJSB
Specification Number: UNKNOWN
Spec Type, Grade, Class: UNKNOWN
Hazard Characteristic Code: F2
Unit Of Issue:
Unit Of Issue Container Qty: UNKNOWN
Type Of Container: UNKNOWN
Net Unit Weight: UNKNOWN
C/State License Number: N/R
c Explosive Weight: N/R
Net Propellant Weight-Ammo: N/R
Coast Guard Ammunition Code: N/R

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Ingredients/Identity Information
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Proprietary: NO
Ingredient: BENZENE (SARA III)
Ingredient Sequence Number: 01
Percent: 4
Ingredient Action Code: A
Ingredient Focal Point: D
NIOSH (RTECS) Number: CY1400000
CAS Number: 71-43-2
OSHA PEL: SEE 1910.1028
ACGIH TLV: 10 PPM; A2; 9394
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: ETHYL BENZENE (SARA III)
Ingredient Sequence Number: 02
Percent: 2
Ingredient Action Code: A
Ingredient Focal Point: D
NIOSH (RTECS) Number: DA0700000
CAS Number: 100-41-4
OSHA PEL: 100 PPM
ACGIH TLV: 100 PPM/125STEL;9394
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: TOLUENE (SARA III)
Ingredient Sequence Number: 03
Percent: 22
Ingredient Action Code: A
Ingredient Focal Point: D
NIOSH (RTECS) Number: XS5250000
CAS Number: 108-88-3
OSHA PEL: 200 PPM; Z-2
ACGIH TLV: S, 50 PPM; 9394
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: CYCLOHEXANE (SARA III)
Ingredient Sequence Number: 04
Percent: 5
Ingredient Action Code: A
Ingredient Focal Point: D
NIOSH (RTECS) Number: GU6300000
CAS Number: 110-82-7
OSHA PEL: 300 PPM
ACGIH TLV: 300 PPM, 9394
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: XYLENES (O-,M-,P- ISOMERS) (SARA III)
Ingredient Sequence Number: 05
Percent: 10
Ingredient Action Code: A
Ingredient Focal Point: D

NIOSH (RTECS) Number: ZE2100000
CAS Number: 1330-20-7
HA PEL: 100 PPM
CGIH TLV: 100 PPM/150STEL;9394
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: MTBE (METHYL TERT-BUTYL ETHER) (SARA III)
Ingredient Sequence Number: 06
Percent: 7
Ingredient Action Code: A
Ingredient Focal Point: D
NIOSH (RTECS) Number: KN5250000
CAS Number: 1634-04-4
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: PETROLEUM NAPHTHA
Ingredient Sequence Number: 07
Percent: UNKNOWN
Ingredient Action Code: A
Ingredient Focal Point: D
NIOSH (RTECS) Number: 1006079PN
CAS Number: UNKNOWN
OSHA PEL: NOT ESTABLISHED
CGIH TLV: NOT ESTABLISHED
her Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: PETROLEUM DISTILLATE
Ingredient Sequence Number: 08
Percent: UNKNOWN
Ingredient Action Code: A
Ingredient Focal Point: D
NIOSH (RTECS) Number: 1011251PD
CAS Number: UNKNOWN
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE RECOMMENDED

Physical/Chemical Characteristics

Appearance And Odor: COLORLESS LIQUID; FUEL OIL ODOR
Boiling Point: >250F,>121C
Melting Point: UNKNOWN
Vapor Pressure (MM Hg/70 F): 104 MM HG
Vapor Density (Air=1): UNKNOWN
Specific Gravity: 0.75-0.8
Decomposition Temperature: UNKNOWN
Evaporation Rate And Ref: UNKNOWN
Solubility In Water: UNKNOWN
rcent Volatiles By Volume: N/K
scosity: N/R
pH: N/K
Radioactivity: N/R

Form (Radioactive Matl): N/R
Magnetism (Milligauss): N/R
Corrosion Rate (IPY): UNKNOWN
Autoignition Temperature: 468F

Fire and Explosion Hazard Data

Flash Point: >-10F,>-23C
Flash Point Method: CC
Lower Explosive Limit: 1.3
Upper Explosive Limit: 8
Extinguishing Media: AGENTS APPROVED FOR CLASS B HAZARDS; SUCH AS DRY CHEMICAL, CARBON DIOXIDE, FOAM, STEAM AND WATER FOG.
Special Fire Fighting Proc: NONE SPECIFIED BY MANUFACTURER. HMIS-WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL BUNKER GEAR.
Unusual Fire And Expl Hazrds: FLAMMABLE LIQUID. VAPOR MAY EXPLODE IF IGNITED IN ENCLOSED AREA.

Reactivity Data

Stability: YES
Cond To Avoid (Stability): KEEP AWAY FROM SOURCES OF IGNITION.
Materials To Avoid: NONE IDENTIFIED. HMIS-STRONG OXIDIZING AGENTS.
Hazardous Decomp Products: CARBON MONOXIDE AND CARBON DIOXIDE
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NONE

Health Hazard Data

LD50-LC50 Mixture: ORAL LD50 (RAT) IS UNKNOWN
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: NO
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: ACUTE: INHALATION OF VAPORS/MIST MAY BE HARMFUL. CONTACT WITH EYES MAY CAUSE EYE DISCOMFORT. INGESTION OR INHALATION MAY CAUSE ASPIRATION OF FUEL WHICH CAN DAMAGE LUNGS OR BE FATAL. CHRONIC: PROLONGED OR REPEATED EXPOSURE MAY CAUSE SKIN IRRITATION. CONTAINS BENZENE A KNOWN CARCINOGEN; MAY CAUSE CANCER.
Carcinogenicity - NTP: YES
Carcinogenicity - IARC: YES
Carcinogenicity - OSHA: YES
Explanation Carcinogenicity: CONTAINS Benzene [71-43-2] WHICH IS LISTED BY NTP AND IARC AND REGULATED BY OSHA AS A CARCINOGEN.
Signs/Symptoms Of Overexp: INHALED: HEADACHES, DIZZINESS, DROWSINESS, AND NAUSEA. EYES: TEARING, DISCOMFORT. SKIN: REDNESS, DISCOMFORT. INGESTED: NONE SPECIFIED BY MANUFACTURER.
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
Emergency/First Aid Proc: INHALED: REMOVE TO FRESH AIR. GIVE ARTIFICIAL RESPIRATION IF NOT BREATHING. GET MEDICAL ATTENTION. EYES: FLUSH WITH PLENTY OF WATER. GET MEDICAL ATTENTION IF IRRITATION PERSISTS. SKIN: REMOVE CONTAMINATED CLOTHES. WASH WITH SOAP AND WATER. GET MEDICAL ATTENTION IF IRRITATION DEVELOPS. INGESTED: DO NOT INDUCE VOMITING! GET IMMEDIATE MEDICAL ATTENTION.

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Precautions for Safe Handling and Use

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Steps If Matl Released/Spill: ELIMINATE ALL SOURCES OF IGNITION. INCREASE VENTILATION IF POSSIBLE. USE WATER SPRAY TO DISPERSE VAPORS. HMIS-ABSORB ON INERT MATERIAL AND PLACE IN A CONTAINER FOR LATER DISPOSAL. IF ENTERS WATERWAYS NOTIFY NATIONAL RESPONSE CTR 800-424-8802.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: DISPOSE OF IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATIONS. ENCLOSED-CONTROLLED INCINERATION IS RECOMMENDED UNLESS DIRECTED OTHERWISE BY APPLICABLE ORDANCES.
Precautions-Handling/Storing: STORE IN A COOL, DRY PLACE AWAY FROM IGNITION SOURCES AND STRONG OXIDIZING AGENTS.
Other Precautions: KEEP CONTAINERS CLOSED. USE WITH ADEQUATE VENTILATION.

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Control Measures

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Respiratory Protection: IF ENGINEERING CONTROLS FAIL OR NON-ROUTINE USE OR EMERGECY OCCURS; USE NIOSH/MSHA APPROVED RESPIRATOR OR SUPPLIED AIR RESPIRATOR OR SCBA, AS REQUIRED. USE IN ACCORDANCE WITH 29 CFR 1910.134.
Ventilation: USE ADEQUATE EXPLOSION-PROOF MECHANICAL VENTILATION TO MAINTAIN EXPOSURE BELOW TLV.
Protective Gloves: NITRILE, PVA
Eye Protection: HMIS-SAFETY GLASSES, MFR-NONE REQUIRED.
Other Protective Equipment: WEAR PROTECTIVE CLOTHES NEEDED TO PREVENT PROLONGED OR REPEATED CONTACT.
Work Hygienic Practices: WASH HANDS AFTER USE AND BEFORE EATING, DRINKING, OR SMOKING. LAUNDER CONTAMINATED CLOTHES BEFORE REUSE.
Suppl. Safety & Health Data:

DOD Hazardous Materials Information System
DoD 6050.5-LR
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FSC: 6850
NIIN: 000822522
Manufacturer's CAGE: 5A188
Part No. Indicator: A
Part Number/Trade Name: JP 4 JET FUEL ADDITIVE

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General Information

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Item Name: INHIBITOR, ICING, FUEL SYSTEM
Manufacturer's Name: ASHLAND CHEMICAL, INC. SUBS. OF ASHLAND OIL, INC.
Manufacturer's Street:
Manufacturer's P. O. Box: 2219
Manufacturer's City: COLUMBUS
Manufacturer's State: OH
Manufacturer's Country: US
Manufacturer's Zip Code: 43216
Manufacturer's Emerg Ph #: 800-274-5263
Manufacturer's Info Ph #: 614-889-3333
Distributor/Vendor # 1: CHEMICAL COMMODITIES
Distributor/Vendor # 1 Cage: 60777
Distributor/Vendor # 2:
Distributor/Vendor # 2 Cage:
Distributor/Vendor # 3:
Distributor/Vendor # 3 Cage:
Distributor/Vendor # 4:
Distributor/Vendor # 4 Cage:
Safety Data Action Code:
Safety Focal Point: D
Record No. For Safety Entry: 007
Tot Safety Entries This Stk#: 010
Status: SE
Date MSDS Prepared: 22DEC88
Safety Data Review Date: 29AUG90
Supply Item Manager: CX
MSDS Preparer's Name:
Preparer's Company:
Preparer's St Or P. O. Box:
Preparer's City:
Preparer's State:
Preparer's Zip Code:
Other MSDS Number:
MSDS Serial Number: BCYBG
Specification Number: MIL-I-27686E
Spec Type, Grade, Class:
Hazard Characteristic Code: F4
Unit Of Issue: GL
Unit Of Issue Container Qty: BULK
Type Of Container: TANKER
Net Unit Weight: N/R
NRC/State License Number:
Net Explosive Weight:
Net Propellant Weight-Ammo:
Coast Guard Ammunition Code:

Ingredients/Identity Information

oprietary: NO
Ingredient: 2-METHOXYETHANOL (EGME) (SARA III)
Ingredient Sequence Number: 01
Percent: 100%
Ingredient Action Code:
Ingredient Focal Point: D
NIOSH (RTECS) Number: KL5775000
CAS Number: 109-86-4
OSHA PEL: S, 25 PPM
ACGIH TLV: S, 5 PPM; 9192
Other Recommended Limit: NOT ESTABLISHED

Physical/Chemical Characteristics

Appearance And Odor: COLORLESS LIQUID,MILD ODOR.
Boiling Point: 255F(124C)
Melting Point: N/R
Vapor Pressure (MM Hg/70 F): 9.5
Vapor Density (Air=1): 2.60
Specific Gravity: 0.961
Decomposition Temperature: UNKNOWN
Evaporation Rate And Ref: 1.0,BUTYL ACETATE
Solubility In Water: COMPLETE
Percent Volatiles By Volume: 100
Viscosity:

Radioactivity:
Form (Radioactive Matl):
Magnetism (Milligauss):
Corrosion Rate (IPY): UNKNOWN
Autoignition Temperature:

Fire and Explosion Hazard Data

Flash Point: 100F,38C
Flash Point Method: TCC
Lower Explosive Limit: 1.8
Upper Explosive Limit: 14.0
Extinguishing Media: USE WATER FOG, CARBON DIOXIDE, FOAM, OR DRY CHEMICAL.
Special Fire Fighting Proc: FIRE FIGHTERS SHOULD USE NIOSH APPROVED SCBA & FULL PROTECTIVE EQUIPMENT WHEN FIGHTING CHEMICAL FIRE. USE WATER SPRAY TO COOL NEARBY CONTAINERS EXPOSED TO FIRE.
Unusual Fire And Expl Hazrds: VAPORS ARE HEAVIER THAN AIR, MAY TRAVEL AND BE IGNITEDEXPLOSIVELY. NEVER CUT OR WELD ON OR NEAR DRUM, RESIDUE WILL IGNITE.

Reactivity Data

Stability: YES
Cond To Avoid (Stability): HIGH TEMPERATURES, SPARKS, AND OPEN FLAMES
Materials To Avoid: STRONG OXIDIZING AGENTS
ardous Decomp Products: CO*2,CO,ETC.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): N/R

Health Hazard Data

LD50-LC50 Mixture:
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: SEE SIGNS & SYMPTOMS OF OVEREXPOSURE
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: N/R
Signs/Symptoms Of Overexp: EYES:MODERATE IRRITATION,REDNESS,TEARING; SKIN CONTACT:MODERATE IRRITATION,DEFATTING,DERMATITIS;SKIN ABSORPTION:CAN BE ABSORBED IN TOXIC AMOUNTS;INHALATION:NASAL & RESPIRATORY IRRITATION, DIZZINESS,WEAKNESS,FATIGUE,NAUSEA,HEADACHE,UNCONSCIOUSNESS,ASPHYXIATION; INGESTION:GASTROINTESTINAL IRRITATION,NAUSEA,VOMIT,DIARRHEA.
Med Cond Aggravated By Exp: NONE NOTED.
Emergency/First Aid Proc: SKIN:THOROUGHLY WASH AREA W/SOAP & WATER. REMOVE CONT. CLTHG.LAUNDER CONT.CLTHG BEFORE REUSE.EYES:FLUSH W/LARGE AMTS OF WATER.INGEST:GIVE TWO GLASSES OF WATER,INDUCE VOMITING.CALL DR. INHALED: REMOVE TO FRESH AIR.IF BREATHING DIFFICULT GIVE CPR.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: SMALL SPILL:ABSORB LIQUID ON PAPER, VERMICULITE,FLOOR ABSORBENT,OR OTHER ABSORBENT MATERIAL & TRANSFER TO HOOD. LARGE SPILL:ELIMINATE ALL IGNITION SOURFCES.PERSONS NOT WEARING PROTECTIVE EQUIP.SHOULD BE EXCLUDED FROM AREA OF SPILL UNTIL(SEE SUPPL DATA)
Neutralizing Agent:
Waste Disposal Method: SMALL SPILL:ALLOW VOLATILE PORTION TO EVAPORATE IN HOOD.ALLOW SUFFICIENT TIME FOR VAPORS TO COMPLETELY CLEAR HOOD DUCT WORK. DESTROY REMAINING MATERIAL BY BURNING IN AN IRON PAN.LARGE SPILL:DESTROY BY LIQUID INCINERATION,CONT.ABSORB DEPOSIT IAW FED RE
Precautions-Handling/Storing: CONTAINERS OF THIS MATERIAL MAY BE HAZARDOUS WHEN EMPTIED.SINCE EMPTIED CONTAINERS RETAIN PRODUCT RESIDUES(VAPOR,LIQ,&/ OR SOLID,ALL HAZ PRECAUTIONS GI
Other Precautions: NONE

Control Measures

Respiratory Protection: NIOSH/MSHA JOINTLY APPD AIR SUPPLIED RESPIRATORS
Ventilation: LOCAL EXHAUST IS RECOMMENDED TO MAINTAIN EXPOSURE < TLVS
Protective Gloves: PVA,NEOPRENE
Eye Protection: CHEMICAL SPLASH GOGGLES.
Other Protective Equipment: WEAR IMPERVIOUS CLOTHING & BOOTS.
Work Hygienic Practices: WASH THOROUGHLY AFTER HANDLING. REMOVE & LAUNDER CONTAMINATED CLOTHING.
Suppl. Safety & Health Data: LARGE SPILL(CONTD):CLEAN UP HAS BEEN COMPLETED.STOP SPILL AT SOURCE,DIKE AREA OF SPILL,PUMP LIQUID TO SALVAGE TK,REMAINING LIQ.TAKEN UP ON SAND,CLAY,EARTH,FLOOR ABSORBENT.OR OTHER ABS. INTO CON

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FSC: 9130
NIIN: 002646215
Manufacturer's CAGE: 2X948
Part No. Indicator: B
Part Number/Trade Name: LEADED GASOLINE

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General Information
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Item Name: GASOLINE, AUTOMOTIVE
Manufacturer's Name: SINCLAIR OIL CORPORATION
Manufacturer's Street: 550 E SOUTH TEMPLE
Manufacturer's P. O. Box:
Manufacturer's City: SALT LAKE CITY
Manufacturer's State: UT
Manufacturer's Country: US
Manufacturer's Zip Code: 84102
Manufacturer's Emerg Ph #: 801-524-2700
Manufacturer's Info Ph #: 801-524-2700
Distributor/Vendor # 1:
Distributor/Vendor # 1 Cage:
Distributor/Vendor # 2:
Distributor/Vendor # 2 Cage:
Distributor/Vendor # 3:
Distributor/Vendor # 3 Cage:
stributor/Vendor # 4:
Distributor/Vendor # 4 Cage:
Safety Data Action Code:
Safety Focal Point: D
Record No. For Safety Entry: 015
Tot Safety Entries This Stk#: 029
Status: FM
Date MSDS Prepared: 23APR91
Safety Data Review Date: 29APR93
Supply Item Manager: KY
MSDS Preparer's Name:
Preparer's Company:
Preparer's St Or P. O. Box:
Preparer's City:
Preparer's State:
Preparer's Zip Code:
Other MSDS Number:
MSDS Serial Number: BQNBM
Specification Number: VV-G-001690A
Spec Type, Grade, Class: REGULAR LEADED
Hazard Characteristic Code: F2
Unit Of Issue: DR
Unit Of Issue Container Qty: 54 GALLONS
Type Of Container: DRUM
Net Unit Weight: 320.6 LBS
C/State License Number:
Explosive Weight: N/R
Net Propellant Weight-Ammo:
Coast Guard Ammunition Code: N/R

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Ingredients/Identity Information
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Proprietary: NO
Ingredient: CYCLOHEXANE (SARA III)
Ingredient Sequence Number: 01
Percent: 1-2
Ingredient Action Code:
Ingredient Focal Point: D
NIOSH (RTECS) Number: GU6300000
CAS Number: 110-82-7
OSHA PEL: 300 PPM
ACGIH TLV: 300 PPM, 9293
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: BENZENE (SARA III)
Ingredient Sequence Number: 02
Percent: 0.6-5.3
Ingredient Action Code:
Ingredient Focal Point: D
NIOSH (RTECS) Number: CY1400000
CAS Number: 71-43-2
OSHA PEL: 1PPM/5STEL;1910.1028
ACGIH TLV: 10 PPM; A2; 9293
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: TOLUENE (SARA III)
Ingredient Sequence Number: 03
Percent: 5.1-6.7
Ingredient Action Code:
Ingredient Focal Point: D
NIOSH (RTECS) Number: XS5250000
CAS Number: 108-88-3
OSHA PEL: 200 PPM/150 STEL
ACGIH TLV: 50 PPM; 9293
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: XYLENES (O-,M-,P- ISOMERS) (SARA III)
Ingredient Sequence Number: 04
Percent: 7.5-12
Ingredient Action Code:
Ingredient Focal Point: D
NIOSH (RTECS) Number: ZE2100000
CAS Number: 1330-20-7
OSHA PEL: 100 PPM/150 STEL
ACGIH TLV: 100 PPM/150STEL;9293
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: NAPHTHALENE (SARA III)
Ingredient Sequence Number: 05
Percent: 1.1-1.5
Ingredient Action Code:
Ingredient Focal Point: D

NIOSH (RTECS) Number: QJ0525000
CAS Number: 91-20-3
[illegible]HA PEL: 10 PPM/15 STEL
[illegible]CGIH TLV: 10 PPM/15 STEL; 9293
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: METHYL TERT-BUTYL ETHER (SARA III)
Ingredient Sequence Number: 06
Percent: 2-15
Ingredient Action Code:
Ingredient Focal Point: D
NIOSH (RTECS) Number: KN5250000
CAS Number: 1634-04-4
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: LEAD (SARA III) 4.23 GRAMS/GALLON MAX PER TIR
Ingredient Sequence Number: 07
Percent: N/K
Ingredient Action Code:
Ingredient Focal Point: D
NIOSH (RTECS) Number: OF7525000
CAS Number: 7439-92-1
OSHA PEL: 0.05 MG/M3;1910.1025
[illegible]CGIH TLV: 0.15 MG/M3;DUST 9293
[illegible]her Recommended Limit: NONE RECOMMENDED

Physical/Chemical Characteristics

Appearance And Odor: AMBER LIQUID, CHARACTERISTIC ODOR
Boiling Point: NOT GIVEN
Melting Point: <-76F,<-60C
Vapor Pressure (MM Hg/70 F): 9-15 PSIA
Vapor Density (Air=1): NOT GIVEN
Specific Gravity: 0.7
Decomposition Temperature: NOT GIVEN
Evaporation Rate And Ref: NOT GIVEN
Solubility In Water: NEGLIGIBLE
Percent Volatiles By Volume: 100 %
Viscosity:
pH: N/K
Radioactivity: N/R
Form (Radioactive Matl): N/R
Magnetism (Milligauss): N/R
Corrosion Rate (IPY): UNKNOWN
Autoignition Temperature: > 500F

Fire and Explosion Hazard Data

Flash Point: -45F,-43C
[illegible]ash Point Method: N/K
[illegible]wer Explosive Limit: 1.4 %
Upper Explosive Limit: 7.6 %
Extinguishing Media: CARBON DIOXIDE, FOAM, DRY CHEMICAL, HALON OR WATER

FOG
Special Fire Fighting Proc: KEEP PERSONNEL REMOVED FROM AND UP-WIND OF FIRE. FIREFIGHTERS SHOULD USE SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE EQUIPMENT.
Unusual Fire And Expl Hazrds: COOL ADJACENT STRUCTURES AND STORAGE DRUMS WITH WATER SPRAY. EVACUATE AREA. PREVENT RUNOFF FROM FIRE CONTROL DILUTION FROM ENTERING STREAMS OR DRINKING WATER.

Reactivity Data

Stability: YES
Cond To Avoid (Stability): HEAT, SPARKS, FLAME AND STATIC ELECTRICITY
Materials To Avoid: HALOGENS, STRONG ACIDS, ALKALIES, OXIDIZERS
Hazardous Decomp Products: CARBON MONOXIDE FROM INCOMPLETE COMBUSTION
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NONE. WILL NOT OCCUR.

Health Hazard Data

LD50-LC50 Mixture: NOT SPECIFIED BY MANUFACTURER.
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: EYE IRRITATION, SKIN IRRITATION, CENTRAL NERVOUS SYSTEM DISTURBANCES, ASPIRATION HAZARD, GASTROINTESTINAL DISTURBANCES, POSSIBLY CARCINOGENIC.
Carcinogenicity - NTP: YES
Carcinogenicity - IARC: YES
Carcinogenicity - OSHA: YES
Explanation Carcinogenicity: THIS PRODUCT CONTAINS BENZENE [71-43-2], AN OSHA REGULATED CARCINOGEN, AN NTP REGULATED CARCINOGEN AND IARC CATEGORY 1.
Signs/Symptoms Of Overexp: EYE IRRITATION, SKIN IRRITATION/BURNS/ DRYING, WEAKNESS, HEADACHE, NAUSEA, CONFUSION, BLURRED VISION, DROWSINESS, DIZZINESS, IRREGULAR HEARTBEAT, COMA, COLLAPSE, DEATH, PULMONARY EDEMA, PERMANENT LUNG DAMAGE, VOMITING, DIARRHEA, ABDOMINAL PAIN, KIDNEY DAMAGE.
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
Emergency/First Aid Proc: EYES: FLUSH IMMEDIATELY WITH WATER FOR 15 MINUTES. SEEK MEDICAL ATTENTION PROMPTLY. SKIN: WASH CONTACT AREAS WITH SOAP AND WATER. INGESTION: DO NOT INDUCE VOMITING. GET MEDICAL ASSISTANCE. INHALATION: REMOVE FROM FURTHER EXPOSURE. IF UNCONSCIOUSNESS OCCURS, SEEK IMMEDIATE MEDICAL ASSISTANCE. IF BREATHING STOPS, USE MOUTH TO MOUTH RESUSCITATION.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: TREAT AS AN OIL SPILL. REPORT SPILLS TO APPROPRIATE AUTHORITIES. WLIMINATE ALL SOURCES OF IGNITION. REMOVE LEAKING CONTAINERS TO A SAFE AREA. CONTAIN AND REMOVE BY MECHANICAL MEANS. GUARD AGAINST CONTAMINATION OF WATER SUPPLIES.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: PREVENT WASTE FROM CONTAMINATING SURROUNDING ENVIRONMENT. DISCARD ANY PRODUCT, RESIDUE, DISPOSAL CONTAINER OR LINER IN ACCORDANCE WITH ALL FEDERAL, STATE AND LOCAL REGULATIONS.
Precautions-Handling/Storing: STORE AWAY FROM IGNITION SOURCES IN A COOL AREA. OUTSIDE OR DETACHED STORAGE IS PREFERRED. GROUND AND BOND ALL TRANSFER AND STORAGE EQUIPMENT.
Other Precautions: DRUMS MUST BE GROUNDED/BONDED/EQUIPPED WITH SELF-

CLOSING VALVE, PRESSURE VACUUM BUNGS, AND FLAME ARRESTERS. CONTAINERS SHOULD BE LABELED: FLAMMABLE. VAPOR HARMFUL. USE NON-SPARKING TOOLS AND)UIPMENT. DO NOT USE AS A CLEANER OR SOLVENT.

Control Measures

Respiratory Protection: APPROVED RESPIRATORY PROTECTION MUST BE USED WHEN VAPOR OR MIST CONCENTRATIONS ARE UNKNOWN OR EXCEED THE TLV. AVOID PROLONGED OR REPEATED BREATHING OF VAPOR OR MISTS.
Ventilation: RECOMMENDED
Protective Gloves: IMPERVIOUS GLOVES
Eye Protection: FULL FACE SHIELD, CHEMICAL GOGGLES
Other Protective Equipment: BOOTS AND WHOLE BODY PROTECTION
Work Hygienic Practices: WASH WITH SOAP AND WATER AFTER HANDLING PRODUCT AND BEFORE EATING DRINKING OR SMOKING.
Suppl. Safety & Health Data: DO NOT USE AS A CLEANER OR SOLVENT. USE ONLY AS MOTOR FUEL. DO NOT SIPHON BY MOUTH.

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DoD 6050.5-LR
AS OF August 1994
Proprietary Version - For U.S. Government Use Only

FSC: 9150
NIIN: 00N034275
Manufacturer's CAGE: 60098
Part No. Indicator: A
Part Number/Trade Name: MOTOR OIL

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General Information
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Item Name:
Manufacturer's Name: J D STREETT & CO INC
Manufacturer's Street: 144 WELDON PARKWAY
Manufacturer's P. O. Box:
Manufacturer's City: MARYLAND HEIGHTS
Manufacturer's State: MO
Manufacturer's Country: US
Manufacturer's Zip Code: 63043
Manufacturer's Emerg Ph #: 314-432-6600
Manufacturer's Info Ph #: 314-432-6600
Distributor/Vendor # 1:
Distributor/Vendor # 1 Cage:
Distributor/Vendor # 2:
Distributor/Vendor # 2 Cage:
Distributor/Vendor # 3:
Distributor/Vendor # 3 Cage:
Distributor/Vendor # 4:
Distributor/Vendor # 4 Cage:
Safety Data Action Code:
Safety Focal Point: N
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 01DEC86
Safety Data Review Date: 12SEP92
Supply Item Manager:
MSDS Preparer's Name:
Preparer's Company:
Preparer's St Or P. O. Box:
Preparer's City:
Preparer's State:
Preparer's Zip Code:
Other MSDS Number:
MSDS Serial Number: BPXMP
Specification Number:
Spec Type, Grade, Class:
Hazard Characteristic Code: NK
Unit Of Issue:
Unit Of Issue Container Qty:
Type Of Container:
Net Unit Weight:
NRC/State License Number:
Net Explosive Weight:
Net Propellant Weight-Ammo:
Coast Guard Ammunition Code:

Ingredients/Identity Information

Proprietary: NO
Ingredient: BASE LUBRICATING OILS, MIXTURE
Ingredient Sequence Number: 01
Percent: 80-90
Ingredient Action Code:
Ingredient Focal Point: N
NIOSH (RTECS) Number: 1004916BL
CAS Number: N/K
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE
Other Recommended Limit: N/K

Proprietary: NO
Ingredient: SUPP DATA:MAY OCCUR, ESPECIALLY IF SPRAYED INTO CONTAINERS OF HOT, BURNING LIQUID.
Ingredient Sequence Number: 05
Percent: N/K
Ingredient Action Code:
Ingredient Focal Point: N
NIOSH (RTECS) Number: 9999999ZZ
CAS Number: N/K
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE
Other Recommended Limit: N/K

Physical/Chemical Characteristics

Appearance And Odor: CLEAR AMBER COLOR-MILD BLAND PETROLEUM ODOR
Boiling Point: >800F,>427C
Melting Point: -30F,-34C
Vapor Pressure (MM Hg/70 F): N/A
Vapor Density (Air=1): N/A
Specific Gravity: 0.876
Decomposition Temperature: N/K
Evaporation Rate And Ref: N/A
Solubility In Water: NIL
Percent Volatiles By Volume: N/K
Viscosity:
pH: N/K
Radioactivity:
Form (Radioactive Matl):
Magnetism (Milligauss):
Corrosion Rate (IPY): N/K
Autoignition Temperature:

Fire and Explosion Hazard Data

Flash Point: 360F,182C
Flash Point Method: COC
Lower Explosive Limit: N/K
Upper Explosive Limit: N/K
Extinguishing Media: USE DRY CHEMICAL, FOAM OR CARBON DIOXIDE.
Special Fire Fighting Proc: WEAR NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N). WATER MAY BE INEFTIVE BUT MAY BE USED TO COOL

CLSD CNTNRS EXPOSED TO HEAT/FLAME. (SUPP DATA)
Unusual Fire And Expl Hazrds: DENSE SMOKE MAY BE GENERATED WHILE BURNING. CO, CO*2 AND OTHER OXIDES MAY BE GENERATED AS PRODUCTS OF COMBUSTION.

Reactivity Data

Stability: YES
Cond To Avoid (Stability): EXCESSIVE HEAT AND STRONG OXIDIZERS.
Materials To Avoid: AVOID STRONG OXIDIZING AGENTS.
Hazardous Decomp Products: FUMES, SMOKE, CARBON MONOXIDE, ETC. IN CASE OF INCOMPLETE COMBUSTION.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT.

Health Hazard Data

LD50-LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: NO
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: HEALTH STUDIES HAVE SHOWN THAT MANY HYDROCARBONS AND SYNTHETIC LUBRICANTS POSE POTENTIAL HUMAN HEALTH RISKS WHICH MAY VARY FROM PERSON TO PERSON. AS A PRECAUTION, EXPSOURE TO ALL LIQUID, VAPORS, MISTS OF FUMES SHOULD BE MINIMIZED.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NOT RELEVANT.
Signs/Symptoms Of Overexp: SEE HEALTH HAZARDS.
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
Emergency/First Aid Proc: INGEST:CALL MD IMMEDIATELY. DO NOT INDUCE VOMITING. SKIN:FLUSH WITH COPIOUS AMOUNTS OF WATER. CALL MD (FP N). EYE: FLUSH WITH POTABLE WATER FOR A MINIMUM OF 15 MINUTES. CALL MD (FP N). INHAL:MOVE TO FRESH AIR. SUPPORT BREATHING (GIVE O*2/ARTF RESP) (FP N).

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: RECOVER FREE PRODUCT, ADD SAND, EARTH, OR OTHER SUITABLE ABSORBANT TO SPILL AREA. MINIMIZE SKIN CONTACT. KEEP PRODUCT OUT OF SEWERS AND WATER COURSES BY DIKING OR IMPOUNDING. ADVISE AUTHORITIES. CONFORM WITH GOVERNMENT REGULATIONS.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: CONTROLLED INCINERATION-SINCE WASTE OIL IS CONSIDERED HAZARDOUS WASTE, CONTACT QUALIFIED AND CERTIFIED DISPOSAL AGENCY IN COMPLIANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS.
Precautions-Handling/Storing: EMPTY CONTAINERS RETAIN RESIDUE (LIQUID OR FUMES) & CAN BE DANGEROUS. DO NOT STORE IN TEMPERATURE ABOVE 150F.
Other Precautions: DO NOT CUT, PRESSURIZE, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS OR OTHER SOURCES OF IGNITION. THEY MAY EXPLODE & CAUSE INJURY OR DEATH. EMPTY DRUMS SHOULD BE COMPLETELY DRAINED, PROPERLY (SUPDAT)

Control Measures

Respiratory Protection: USE NIOSH/MSHA APPROVED SUPPLIED AIR PROTECTION IN CONFINED AREAS.
Ventilation: LOCAL EXHAUST:PROVIDE SUFFICIENT VENTILATION TO PREVENT

EXCEEDING EXPOSURE LIMIT.
Protective Gloves: CHEMICAL RESISTANT GLOVES.
ye Protection: CHEMICAL WORKERS GOGGLES (FP N).
ther Protective Equipment: IMPERVIOUS OUTER CLOTHING.
Work Hygienic Practices: COMSUMPTION OF FOOD & BEVERAGES SHOULD BE AVOIDED IN WORK AREAS WHERE HYDROCARBONS PRESENT. ALWAYS WASH HANDS (SUPDAT)
Suppl. Safety & Health Data: OTHER PREC:BUNGED & PROMPTLY RETURNED TO DRUM RECONDITIONER. ALL OTHER CNTNRS SHOULD BE DISP IN ENVIRON SAFE MANNER. FOR WORK ON TANKS, REFER TO OSHA REG ANZI Z49-1. HYGIENE PRECT:& FACE W/ SOAP & WATER BEFORE EATING, DRINKING/SMOKING. FIRE FIGHT PROC:CAUTION SHOULD BE EXCERCISED WHEN USING WATER/FOAM AS FROTHING(ING 5)

DOD Hazardous Materials Information System
DoD 6050.5-LR
AS OF August 1994
Proprietary Version - For U.S. Government Use Only

FSC: 6810
NIIN: 00N017590
Manufacturer's CAGE: 5Y748
Part No. Indicator: A
Part Number/Trade Name: TOLUENE

General Information

Item Name:
Manufacturer's Name: CAMBRIDGE ISOTOPE LABS
Manufacturer's Street: 20 COMMERCE WAY
Manufacturer's P. O. Box:
Manufacturer's City: WOBURN
Manufacturer's State: MA
Manufacturer's Country: US
Manufacturer's Zip Code: 01801
Manufacturer's Emerg Ph #: 800-322-1174
Manufacturer's Info Ph #: 617-938-0067
Distributor/Vendor # 1:
Distributor/Vendor # 1 Cage:
Distributor/Vendor # 2:
Distributor/Vendor # 2 Cage:
Distributor/Vendor # 3:
Distributor/Vendor # 3 Cage:
Distributor/Vendor # 4:
Distributor/Vendor # 4 Cage:
Safety Data Action Code:
Safety Focal Point: N
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 26JUN91
Safety Data Review Date: 06SEP91
Supply Item Manager:
MSDS Preparer's Name:
Preparer's Company:
Preparer's St Or P. O. Box:
Preparer's City:
Preparer's State:
Preparer's Zip Code:
Other MSDS Number:
MSDS Serial Number: BLXNB
Specification Number:
Spec Type, Grade, Class:
Hazard Characteristic Code: N/
Unit Of Issue:
Unit Of Issue Container Qty:
Type Of Container:
Net Unit Weight:
NRC/State License Number:
Net Explosive Weight:
Net Propellant Weight-Ammo:
Coast Guard Ammunition Code:

Ingredients/Identity Information

Proprietary: NO
Ingredient: TOLUENE (SARA III)
Ingredient Sequence Number: 01
Percent: N/K
Ingredient Action Code:
Ingredient Focal Point: N
NIOSH (RTECS) Number: XS5250000
CAS Number: 108-88-3
OSHA PEL: 200 PPM/150 STEL
ACGIH TLV: 50 PPM; 9293
Other Recommended Limit: N/K

Physical/Chemical Characteristics

Appearance And Odor: COLORLESS LIQUID.
Boiling Point: 232F,111C
Melting Point: -135F,-93C
Vapor Pressure (MM Hg/70 F): 22
Vapor Density (Air=1): 3.2
Specific Gravity: 0.867
Decomposition Temperature: N/K
Evaporation Rate And Ref: N/K
Solubility In Water: N/K
Percent Volatiles By Volume: N/K
Viscosity:
pH: N/K
Radioactivity:
Form (Radioactive Matl):
Magnetism (Milligauss):
Corrosion Rate (IPY): N/K
Autoignition Temperature:

Fire and Explosion Hazard Data

Flash Point: 40.0F,4.4C
Flash Point Method: N/K
Lower Explosive Limit: 1 %
Upper Explosive Limit: 7 %
Extinguishing Media: CO*2, DRY CHEMICAL POWDER, ALCOHOL/POLYMER FOAM. WATER MAY BE EFFECTIVE FOR COOLING, BUT NOT EFFECTIVE EXTINGUISHMENT.
Special Fire Fighting Proc: WEAR NIOSH/MSHA APPROVED SCBA AND PROTECTIVE EQUIPMENT TO PREVENT CONTACT WITH SKIN AND EYES.
Unusual Fire And Expl Hazrds: DANGER: EXTREMELY FLAMMABLE. VAPOR MAY TRAVEL CONSIDERABLE DISTANCE TO SOURCE OF IGNITION AND FLASH BACK. CONTAINER EXPLOSION MAY OCCUR UNDER FIRE CONDITIONS.

Reactivity Data

Stability: YES
Cond To Avoid (Stability): NONE SPECIFIED BY MANUFACTURER.
Materials To Avoid: OXIDIZING AGENTS. IRON OR FERRIC CHLORIDE CATALYZES A VIGOROUS EXOTHERMIC RXN BETWEEN TOLUENE & SULFUR DICHLORIDE.
Hazardous Decomp Products: TOXIC FUMES OF CARBON MONOXIDE AND CARBON DIOXIDE.

Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NONE SPECIFIED BY MANUFACTURER.

Health Hazard Data

LD50-LC50 Mixture: LD50: (ORAL,RAT) 5000 MG/KG
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: ACUTE: HARMFUL IF SWALLOWED, INHALED, OR ABSORBED THROUGH SKIN. VAPOR OR MIST IS IRRITATING TO THE EYES, MUCOUS MEMBRANES AND UPPER RESPIRATORY TRACT. CAUSES SKIN IRRITATION. SYMPTOMS OF EXPOSURE MAY INCLUDE BURNING SENSATION, COUGHING, WHEEZING, LARYNGITIS, SHORTNESS OF BREATH, HEADACHE, NAUSEA & (SEE EFTS OF OVEREXP)
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NOT RELEVANT
Signs/Symptoms Of Overexp: HLTH HAZ: VOMITING. EXPOSURE CAN CAUSE LUNG IRRITATION, CHEST PAIN AND EDEMA WHICH MAY BE FATAL. CHRONIC: DAMAGE TO THE LIVER. BLOOD EFFECTS. DAMAGE TO THE KIDNEYS. MAY CAUSE NERVOUS SYSTEM DISTURBANCES. EXPOSURE TO AND/OR CONSUMPTION OF ALCOHOL MAY INCREASE TOXIC EFFECTS.
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
Emergency/First Aid Proc: EYES/SKIN: FLUSH WSITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MIN WHILE REMOVING CONTAMINATED CLOTHING AND SHOES. INHAL: REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION, IF BREATHING IS DIFFICULT, GIVE OXYGEN. INGEST: WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS. WASH CONTAMINATED CLOTHING BEFORE REUSE.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: EVACUATE AREA. SHUT OFF ALL SOURCES OF IGNITION. WEAR NIOSH/MSHA APPROVED SCBA, RUBBER BOOTS AND HEAVY RUBBER GLOVES. COVER WITH AN ACTIVATED CARBON ADSORBENT, TAKE UP AND PLACE IN CLOSED CONTAINERS. TRANSPORT OUTDOORS.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER BUT EXERT EXTRA CARE IN IGNITING AS THIS MATERIAL IS HIGHLY FLAMMABLE. OBSERVE ALL FEDERAL, STATE, AND LOCAL LAWS.
Precautions-Handling/Storing: KEEP TIGHTLY CLOSED. KEEP AWAY FROM HEAT, SPARKS, AND OPEN FLAME. STORE UNDER NITROGEN. STORE IN COOL DRY PLACE.
Other Precautions: DO NOT BREATHE VAPOR. AVOID CONTACT WITH EYES, SKIN AND CLOTHING. AVOID PROLONGED OR REPEATED EXPOSURE. READILY ABSORBED THROUGH SKIN. THIS PRODUCT IS SUBJECT TO SARA TITLE III, SEC 313 REQUIREMENTS.

Control Measures

Respiratory Protection: WEAR NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR EXPOSURE OF CONCERN (FP N).
Ventilation: MECHANICAL EXHAUST REQUIRED.
Protective Gloves: CHEMICAL RESISTANT GLOVES.
Eye Protection: CHEMICAL WORKERS GOGGLES (FP N).
Other Protective Equipment: SAFETY SHOWER AND EYE BATH. OTHER PROTECTIVE CLOTHING AS REQUIRED.
Work Hygienic Practices: WASH THOROUGHLY AFTER HANDLING.
Suppl. Safety & Health Data: NONE SPECIFIED BY MANUFACTURER.

DOD Hazardous Materials Information System
DoD 6050.5-LR
AS OF August 1994
Proprietary Version - For U.S. Government Use Only

FSC: 6810
NIIN: 002572479
Manufacturer's CAGE: 70829
Part No. Indicator: A
Part Number/Trade Name: XYLENES

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General Information

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Item Name: XYLENE,TECHNICAL
Manufacturer's Name: J.T.BAKER CHEMICAL CO.
Manufacturer's Street: 222 RED SCHOOL LANE
Manufacturer's P. O. Box: N/K
Manufacturer's City: PHILLIPSBURG
Manufacturer's State: NJ
Manufacturer's Country: US
Manufacturer's Zip Code: 08865-2219
Manufacturer's Emerg Ph #: 201-859-2151 OR 800-424-9300 (CHEMT
Manufacturer's Info Ph #: 201-859-2151
Distributor/Vendor # 1:
Distributor/Vendor # 1 Cage:
Distributor/Vendor # 2:
Distributor/Vendor # 2 Cage:
Distributor/Vendor # 3:
Distributor/Vendor # 3 Cage:
Distributor/Vendor # 4:
Distributor/Vendor # 4 Cage:
Safety Data Action Code:
Safety Focal Point: D
Record No. For Safety Entry: 004
Tot Safety Entries This Stk#: 006
Status: SM
Date MSDS Prepared: 11SEP86
Safety Data Review Date: 17OCT90
Supply Item Manager: CX
MSDS Preparer's Name: N/K
Preparer's Company: VWR SCIENTIFIC
Preparer's St Or P. O. Box: 3745 BAYSHORE BLVD
Preparer's City: BRISBANE
Preparer's State: CA
Preparer's Zip Code: 94005
Other MSDS Number:
MSDS Serial Number: BDPHN
Specification Number: ASTM-D-846
Spec Type, Grade, Class: N/K
Hazard Characteristic Code: F4
Unit Of Issue: PT
Unit Of Issue Container Qty: 16.0 FL OZ
Type Of Container: CAN
Net Unit Weight: 16.0 FL OZ
RC/State License Number: N/R
Net Explosive Weight:
Net Propellant Weight-Ammo: N/R
Coast Guard Ammunition Code:

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Ingredients/Identity Information

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Proprietary: NO
Ingredient: XYLENES (O-,M-,P- ISOMERS) (SARA III)
Ingredient Sequence Number: 01
Percent: 90-100
Ingredient Action Code:
Ingredient Focal Point: D
NIOSH (RTECS) Number: ZE2100000
CAS Number: 1330-20-7
OSHA PEL: 100 PPM/150 STEL
ACGIH TLV: 100 PPM/150STEL;9192
Other Recommended Limit: NONE SPECIFIED

Proprietary: NO
Ingredient: ETHYL BENZENE (SARA III)
Ingredient Sequence Number: 02
Percent: <1.0
Ingredient Action Code:
Ingredient Focal Point: D
NIOSH (RTECS) Number: DA0700000
CAS Number: 100-41-4
OSHA PEL: 100 PPM/125 STEL
ACGIH TLV: 100 PPM/125STEL 9192
Other Recommended Limit: N/R

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Physical/Chemical Characteristics

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Appearance And Odor: COLORLESS LIQUID WITH SWEET PLEASANT ODOR.
Boiling Point: 279F/137C
Melting Point: -54F,-48C
Vapor Pressure (MM Hg/70 F): 5.1 MMHG
Vapor Density (Air=1): 3.7
Specific Gravity: 0.87
Decomposition Temperature: UNKNOWN
Evaporation Rate And Ref: 0.7(N-BUTYL ACETATE=1)
Solubility In Water: NEGLIGIBLE
Percent Volatiles By Volume: 100.0
Viscosity:
pH: N/K
Radioactivity:
Form (Radioactive Matl):
Magnetism (Milligauss):
Corrosion Rate (IPY): UNKNOWN
Autoignition Temperature:

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Fire and Explosion Hazard Data

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Flash Point: 80.0F,26.7C
Flash Point Method: C.C.
Lower Explosive Limit: 1.1
Upper Explosive Limit: 7.0
Extinguishing Media: WATER SPRAY,ALCOHOL FOAM, DRY CHEMICAL OR CARBON DIOXIDE
Special Fire Fighting Proc: FIRE FIGHTERS SHOULD USE NIOSH APPROVED SCBA & FULL PROTECTIVE EQUIPMENT WHEN FIGHTING CHEMICAL FIRE. USE WATER SPRAY TO

COOL NEARBY CONTAINERS EXPOSED TO FIRE.
Unusual Fire And Expl Hazrds: AVOID EXTREME HEAT AND OXIDIZING SUBSTANCES; NTAINERS MAY EXPLODE.

Reactivity Data

Stability: YES
Cond To Avoid (Stability): HIGH TEMPERATURES, SPARKS, AND OPEN FLAMES
Materials To Avoid: STRONG OXIDIZING AGENTS
Hazardous Decomp Products: CARBON MONOXIDE, CARBON DIOXIDE AND OTHER UNIDENTIFIED COMPONENTS.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT APPLICABLE

Health Hazard Data

LD50-LC50 Mixture: LD50 (ORAL RAT) IS 4300 MG/KG
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: ACUTE:IRRITATION OF EYES,SKIN,RESPIRATORY OR G.I.TRACTS;CNS EFFECTS LIKE HEADACHE,DIZZINESS,NAUSEA AND VOMITING. CHRONIC:DRYING OF SKIN,DEFATTING OR DERMATITIS,DAMAGE TO LUNGS,EYES,LIVER OR KIDNEYS. .
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: DATA PER MSDS
Signs/Symptoms Of Overexp: MAY CAUSE IRRITATION OF EYES,SKIN, RESPIRATORY OR G.I.TRACTS;MAY CAUSE HEADACHE,DIZZINESS,NAUSEA,VOMITING OR GI TRACT DISTURBANCES POSSIBLE.BURNS OR REDNESS OF EYES/CRACKING OR DRYNESS OF SKIN.
Med Cond Aggravated By Exp: PERSONS WITH A HISTORY OF AILMENTS OR WITH A PRE-EXISTING DISEASE INVOLVING THE EYES, SKIN, OR RESPIRATORY TRACT MAY BE AT INCREASED RISK FROM EXPOSURE.
Emergency/First Aid Proc: INHALATION:REMOVE TO FRESH AIR. RESUSCITATE IF NOT BREATHING. GET MEDICAL ATTENTION. EYES:IMMEDIATELY FLUSH WITH PLENTY OF WATER FOR 15 MINUTES HOLDING EYELIDS OPEN. GET MEDICAL ATTENTION. SKIN: REMOVE CONTAMINATED CLOTHING. WASH WITH SOAP AND WATER. IF IRRITATION PERSISTS, GET MEDICAL ADVICE. INGESTION:DO NOT INDUCE VOMITING. GIVE NOTHING BY MOUTH IF UNCONSCIOUS. GET IMMEDIATE MEDICAL ATTENTION.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: ELIMINATE IGNITION SOURCES. ABSORB SPILL ON SAND,EARTH, OR VERMICULITE. CAREFULLY SWEEP UP & REMOVE. FLUSH SPILL AREA W/WATER.ALTERNATIVELY USE J.T. BAKERS FLAMMABLE SOLVENT CLEAN-UP KIT(PRODUCT 4437)
Neutralizing Agent: NOT APPLICABLE.
Waste Disposal Method: CONSULT LOCAL AUTHORITIES.DISPOSAL MUST BE MADE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE AND LOCAL LAWS AND REGULATIONS.
Precautions-Handling/Storing: KEEP AWAY FROM HEAT, SPARK, & FLAME. KEEP IN TIGHTLY CLOSED CONTAINER
Other Precautions: DO NOT TAKE INTERNALLY. DO NOT BREATHE MIST. AVOID PROLONGED OR REPEATED BREATHING OF VAPOR. AVOID CONTACT WITH EYES. USE WITH ADEQUATE VENTILATION. WASH THOROUGHLY AFTER HANDLING.

Control Measures

Respiratory Protection: USE NIOSH/MSHA APPROVED RESPIRATOR FOR ORGANIC VAPORS/MIST IF ABOVE PEL/TLV.
Ventilation: LOCAL/GENERAL TO MAINTAIN PEL/TLV.
Protective Gloves: NEOPRENE, NITRILE, OR NATURAL RUBBER
Eye Protection: SAFETY GOGGLES WITH OPTIONAL FACE SHIELD
Other Protective Equipment: EYE WASH STATION AND SAFETY SHOWER,WORK CLOTHING AND APRON AS REQUIRED.
Work Hygienic Practices: OBSERVE GOOD PERSONAL HYGIENE PRACTICES AND RECOMMENDED PROCEDURES. DO NOT WEAR CONTAMINATED CLOTHING OR FOOTWEAR.
Suppl. Safety & Health Data: AVOID PROLONGED OR REPEATED EXPOSURE. DO NOT GET ON SKIN OR IN EYES. DO NOT BREATHE VAPORS OR MISTS.

APPENDIX L

AGREEMENT AND ACKNOWLEDGEMENT SHEET

The Environmental Company, Inc.

HEALTH AND SAFETY PLAN
AGREEMENT AND ACKNOWLEDGEMENT SHEET

TEC Health and Safety Program

INSTRUCTIONS: Field personnel are required to receive a copy of the final health and safety plan (HSP), and to read, understand, and agree to the provisions of the plan. The project manager (PM) has responsibility for distribution of the HSP to personnel as they are assigned to the project. Personnel are required to sign this form indicating receipt of the HSP. The original or this form is maintained by the PM and will become part of the permanent project files. Copies of this form will be sent to the health and safety manager. Updated copies are distributed as additional personnel are assigned to the site.

SITE NAME: ______________________________

LOCATION: ______________________________

I have received a copy, read, understood, and agree to comply with the provisions of the above referenced HSP for work activities on this project at this site.

PRINTED NAME	SIGNATURE	DATE

APPENDIX M

VISITOR/TRAINEE AGREEMENT FORM

The Environmental Company, Inc.

HEALTH AND SAFETY PLAN
VISITOR/TRAINEE AGREEMENT FORM

TEC Health and Safety Program

INSTRUCTIONS: Visitors/trainees are required to receive a copy of the final health and safety plan (HSP), and to read, understand, and agree to the provisions of the plan. The project manager (PM) has responsibility for distribution of the HSP to visitors/trainees. Visitors/trainees are required to sign this form indicating receipt of the HSP. The original or this form is maintained by the PM and will become part of the permanent project files. Copies of this form will be sent to the Project Health and Safety Manager. Updated copies are distributed as necessary.

SITE NAME: ____

LOCATION: ____

I have received a copy, read, understood, and agree to comply with the provisions of the above referenced HSP for work activities on this project at this site.

PRINTED NAME	SIGNATURE	DATE

APPENDIX N

SITE TAILGATE BRIEFING FORM

The Environmental Company, Inc.

SITE TAILGATE BRIEFING FORM

HEALTH AND SAFETY ISSUES DISCUSSED: DATE: ____________

I.

____

____

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II.

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____

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III.

____

____

____

IV.

____

____

____

PRINTED NAME	SIGNATURE	DATE
PRINTED NAME	SIGNATURE	DATE
PRINTED NAME	SIGNATURE	DATE
PRINTED NAME	SIGNATURE	DATE
PRINTED NAME	SIGNATURE	DATE

APPENDIX O

PRELIMINARY INCIDENT REPORT

PRELIMINARY INCIDENT REPORT

Attach a narrative summary of the incident, as appropriate.

NAME ______________________________

SOCIAL SECURITY NUMBER ______________________________

FIRM/REGION ______________________________

DATE OF REPORT ______________________________

SITE NAME______________ TASK/PHASE ______________________________

INCIDENT TYPE: Possible Exposure [ ] Exposure Injury [ ]

DATE OF INCIDENT ______________ TIME ______________________________

LOCATION ______________________________

SITE CONDITIONS AT TIME OF INCIDENT:

Temperature ____________________ Wind Speed & Direction____________________

Humidity____________________ Cloud Cover____________________

Precipitation ____________________ Other____________________

TYPE OF EXPOSURE/INJURY:

MATERIAL EXPOSED TO (chemical compound name, physical state, etc.):

NATURE OF EXPOSURE/INJURY (parts of body exposed/injured, etc.):

MEDICAL CARE RECEIVED (when, where, by whom):

PRELIMINARY INCIDENT REPORT (Cont.)

HAS EXPOSURE/INJURY RESULTED IN:

Death [ ] Permanent Disability [ ] Temporary Disability [ ]
Loss of Work Time [ ] Other [ ]
Explain: ______________________________

OTHER INDIVIDUAL INVOLVED/AFFECTED:

WITNESSES:

POSSIBLE CAUSE OF INJURY/EXPOSURE:

WERE OPERATIONS CONDUCTED USING AN APPROVED HEALTH AND SAFETY PLAN?

YES ( ) Reference ______________________________
NO ( ) Explain ______________________________

WAS INJURY/EXPOSURE DUE TO FAILURE OF PROTECTIVE EQUIPMENT?

NO ( ) YES ( )
Explain: ______________________________

HAS HSM BEEN NOTIFIED? NO( ) YES( )

Employee Signature: ______________________ Date ____________

HSM COMMENTS:

ACTIONS REQUIRED:

HSM ______________________ Date ____________

PHYSICIAN'S COMMENTS:

Physician ______________________ Date ____________

ACTIONS COMPLETED:

HSM ______________________ Date ____________

TAB

Field Sampling Plan

FIELD SAMPLING PLAN

SITE ASSESSMENT, INVESTIGATION, AND CHARACTERIZATION OF THE RECREATIONAL VEHICLE (RV) FAMILY CAMPING (FAM CAMP) AREA

NAVAL AIR STATION (NAS) FORT WORTH JOINT RESERVE BASE (JRB) CARSWELL FIELD, TEXAS

Contract No. F41624-95-D-8002
Delivery Order 0003

July 1996

Prepared for:

Air Force Material Command (AFMC)
Headquarters (HQ) Human Systems Center (HSC) PKVCC
3207 North Road
Brooks AFB, Texas 78235-5353

Prepared by:

The Environmental Company, Inc.
1230 Cedars Court, Suite 100
Post Office Box 5127
Charlottesville, Virginia 22905

DISTRIBUTION

Controlled distribution of the FSP is as follows:

RECIPIENT	NO. OF COPIES	COPY NUMBER
AFCEE		
Charles E. Rice, Contracting Officer's Representative	7	1 - 7
AFBCA		
Olen Long, AFBCA/OL-H NAS Fort Worth	2	8 - 9
TEC		
Jack E. Wilson Project Director	1	10
Glenn M. Metzler Project Manager	1	11

Uncontrolled original distribution is as follows:

TEC Project File	3

COPY NO. 9

PREFACE

A site assessment/investigation (SA/SI) and a site characterization (SC) of the area in the vicinity of the Recreational Vehicle (RV) Family Camping (Fam Camp) Area at Naval Air Station (NAS) Fort Worth, Joint Reserve Base, Carswell Field, Texas (identified as Project No. 95-8021) will be conducted to determine the presence or absence of contamination and to define the nature and extent of such contamination if present.

This Field Sampling Plan (FSP) was prepared by The Environmental Company, Inc. (TEC) under contract No. F41624-95-D-8002, Delivery Order 0003. This FSP is a project scoping document for Project No. 95-8021.

This FSP presents the requirements and procedures for completing SA/SI and SC field operations and investigations. This FSP has been prepared to ensure that data quality objectives specified for this project are accomplished and field sampling protocols are documented and reviewed in a consistent manner.

This FSP was written under the direction of Mr. Glenn M. Metzler, TEC Project Manager. The Contracting Officer's Representative for this project is Mr. Charles Rice, Air Force Center for Environmental Excellence (AFCEE), Environmental Restoration Branch (ERB), Brooks Air Force Base (AFB), Texas.

Approval By: Date:

Glenn M. Metzler (signature) July 9, 96

Glenn M. Metzler
Project Manager
The Environmental Company, Inc.

Approval By: Date:

Jack E. Wilson (signature) July 9, 1996

Jack E. Wilson, P.E.
Project Director
The Environmental Company, Inc.

NOTICE

This report has been prepared for the United States Air Force by The Environmental Company, Inc. (TEC) for the purpose of aiding in the implementation of a final remedial action plan under the Air Force Installation Restoration Program (IRP).

Although the area of study is being investigated in accordance with IRP guidance, the area has not been identified as an IRP site. NAS Fort Worth (formerly Carswell Air Force Base) is undergoing property disposal/reuse pursuant to the Defense Base Closure and Realignment Act of 1990 and Round II of the Base Closure Commission deliberations. The area of study is being considered for property disposal or reuse and the Air Force Base Conversion Agency (AFBCA) desires to investigate the area to confirm or deny the presence of contamination.

As the report relates to actual or possible releases of potentially hazardous substances, its release prior to a United States Air Force final decision on remedial action may be in the public's interest. The limited objectives of this report and the ongoing nature of the IRP, along with the evolving knowledge of site conditions and chemical effects on the environment and health, must be considered when evaluating this report since subsequent facts may become known that may make this report premature or inaccurate.

Acceptance of this report in performance of the contract under which it is prepared does not mean that the Air Force adopts the conclusions, recommendations, or other views expressed herein, which are those of the contractor only and do not necessarily reflect the official position of the United States Air Force.

Copies of this report may be purchased from:

a. Government agencies and their contractors registered with the Defense Technical Information Center (DTIC) should direct requests for copies of this report to:

   Defense Technical Information Center
   Cameron Station
   Alexandria, VA 22304-6145.

b. Non-Government agencies may purchase copies of this document from:

   National Technical Information Service
   5285 Port Royal Road
   Springfield, VA 22161.

REPORT DOCUMENTATION PAGE	Form Approved OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	July 1996	Final-July 1996

4. TITLE AND SUBTITLE

FIELD SAMPLING PLAN
SITE ASSESSMENT, INVESTIGATION, AND CHARACTERIZATION OF THE RECREATIONAL VEHICLE (RV) FAMILY CAMPING (FAM CAMP) AREA
NAVAL AIR STATION (NAS) FORT WORTH
JOINT RESERVE BASE (JRB)
CARSWELL FIELD, TEXAS

5. FUNDING NUMBERS

F41624-95-D-8002
Delivery Order 0003

6. AUTHOR(S)

The Environmental Company, Inc.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

The Environmental Company, Inc.
1230 Cedars Court, Suite 100
Post Office Box 5127
Charlottesville, Virginia 22905

8. PERFORMING ORGANIZATION REPORT NUMBER

NA

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

HQ AFCEE/ERB
Air Force Center for Environmental Excellence
Base Closure Division
Brooks AFB, TX 78235

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

NA

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

This Field Sampling Plan presents, in specific terms, the requirements and procedures for conducting field operations and investigations. This project-specific FSP has been prepared to ensure that the data quality objectives specified for this project are met, the field sampling protocols are documented and reviewed in a consistent manner, and the data collected are scientifically valid and defensible. This site-specific QAPP and the Air Force Center for Environmental Excellence (AFCEE) Field Sampling Plan constitute, by definition, an AFCEE Sampling and Analysis Plan (SAP).

14. SUBJECT TERMS

FIELD SAMPLING PLAN

15. NUMBER OF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	

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LIST OF ACRONYMS AND ABBREVIATIONS

AC	Alternating Current
AF	Air Force
AFB	Air Force Base
AFP4	Air Force Plant 4
AFBCA	Air Force Base Conversion Agency
AFCEE	Air Force Center for Environmental Excellence
ARARs	Applicable or Relevant and Appropriate Requirements
ASTM	American Society of Testing and Materials
BHB	Baird, Hampton, & Brown, Inc.
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
°C	Celsius
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Chain-of-Custody
CO	Contracting Officer
COR	Contracting Officer's Representative
cm	centimeter
CSM	Conceptual Site Model
DBCRA	Defense Base Closure Realignment Act
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DoD	Department of Defense
DOT	Department of Transportation
DNAPL	Dense Non-Aqueous Phase Liquid
DQO	Data Quality Objective
EC	Electrical Conductance
E.I.T.	Engineer-In-Training
EPA	Environmental Protection Agency
ePTFE	polytetrafluoroethylene
ER	Electrical Resistivity
°F	Fahrenheit
Fam Camp	Family Camping
FSP	Field Sampling Plan
ft	feet
g	gamma
g	gram
gal	gallon

GC/MS	Gas Chromotagraphy/Mass Spectroscopy
GPR	Ground Penetrating Radar
HSA	Hollow Stem Auger
HSP	Health and Safety Plan
I-30	Interstate 30
ID	inside diameter
IDW	Investigative-derived waste
IRP	Installation Restoration Program
IRPIMS	Installation Restoration Program Information Management System
JP4	Jet Fuel 4
mg	milligram
mL	milliliter
mm	millimeter
MS	Matrix Spike
MSD	Matrix Spike Duplicate
msl	mean sea level
L	liter
lb	pound
NAPL	Non-Aqueous Phase Liquid
NAS	Naval Air Station
NCP	National Contingency Plan
NTU	Nephlometric Turbidity Unit
OD	Outside diameter
PCB	Polychlorinated Biphenyls
P.E.	Professional Engineer
PID	Photo Ionizing Detector
POC	Point-of-Contact
PVC	Polyvinyl chloride
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
RLS	Registered Land Surveyor
Rone	Rone Engineers, Inc.
RPD	Relative Percent Difference
RV	Recreational Vehicle
SA/SI	Site Assessment/Site Investigation

SB	Soil Boring
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments Reauthorization Act
SC	Site Characterization
SHSC	Site Health and Safety Coordinator
SOW	Scope of Work
SVOC	Semi-Volatile Organic Compound
TAC	Texas Administrative Code
TAL	Target Analyte List
TC	Team Chief
TEC	The Environmental Company, Inc.
TPH	Total Petroleum Hydrocarbons
USCS	United Soil Classification System
USGS	United States Geological Survey
UV	Ultraviolet
VOC	Volatile Organic Compound
YMCA	Young Men's Christian Association
3-D	Three Dimensional

1.0 INTRODUCTION

The Field Sampling Plan (FSP) presents, in specific terms, the requirements and procedures for conducting field operations and investigations. This project-specific FSP has been prepared to ensure that the data quality objectives specified for this project are met, the field sampling protocols are documented and reviewed in a consistent manner, and the data collected are scientifically valid and defensible. This site-specific FSP and the Air Force Center for Environmental Excellence (AFCEE) Quality Assurance Project Plan (QAPP), shall constitute, by definition, an AFCEE Sampling and Analysis Plan (SAP).

The National Contingency Plan (NCP) specifies circumstances under which an FSP is necessary for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response actions. For cleanup actions at the remedial investigation/feasibility study (RI/FS) stage, the NCP requires lead agents to develop sampling and analysis plans which provide a process for obtaining data of sufficient quality and quantity to satisfy data needs. Such sampling and analysis plans must include an FSP (40 CFR 300.430 (b)(8)(ii)).

Naval Air Station Fort Worth (NAS Fort Worth) (formerly Carswell Air Force Base) is currently undergoing property disposal/reuse pursuant to the Defense Base Closure and Realignment Act (DBCRA) of 1990 and Round II of the Base Closure Commission deliberations. The area of study is being considered for property disposal or reuse. The Air Force Base Conversion Agency (AFBCA) desires to investigate the area to confirm the presence or absence of contamination.

This FSP was prepared according to the following guidelines: *Data Quality Objectives Process for Superfund, Interim Final Guidance* (U.S. EPA, 1993) and *Handbook for the Installation Restoration Program (IRP) Remedial Investigations and Feasibility Studies (RI/FS) (AFCEE, September 1993)*, hereafter referred to as the AFCEE Handbook.

This FSP is required reading for all staff participating in the work effort. The FSP shall be in the possession of the field teams collecting the samples. All contractors and subcontractors shall be required to comply with the procedures documented in this FSP to maintain comparability and representativeness of the collected and generated data.

Controlled distribution of the FSP shall be implemented by the prime contractor to ensure that the current approved version is being used. A sequential numbering system shall be used to identify controlled copies of the FSP. Controlled copies shall be provided to applicable Air Force managers, regulatory agencies, remedial project managers, project managers, and quality assurance (QA) coordinators. Whenever Air Force revisions are made or addenda are added to the FSP, a document control system shall be put into place to ensure that all parties holding a controlled copy of the FSP shall receive the revisions/addenda and that outdated material is removed from circulation. The document control system does not preclude making and using copies of the FSP; however, the holder of controlled copies is responsible for distributing additional material to update any copies within their organizations. The distribution list for controlled copies shall be maintained by the prime contractor.

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2.0 PROJECT BACKGROUND

2.1 THE AIR FORCE INSTALLATION RESTORATION PROGRAM

The objective of the U.S. Air Force Installation Restoration Program (IRP) is to assess past hazardous waste disposal and spill sites at U.S. Air Force Installations and to develop remedial actions consistent with the NCP for sites that pose a threat to human health and welfare or the environment. This section presents information on the program origins, objectives, and organization.

The 1976 Resource Conservation Recovery Act (RCRA) is one of the primary Federal laws governing the disposal of hazardous wastes. Sections 6001 and 6003 of RCRA require Federal agencies to comply with local and state environmental regulations and provide information to the EPA concerning past disposal practices at Federal sites. RCRA Section 3012 requires state agencies to inventory past hazardous waste disposal sites and provide information to the EPA concerning these sites.

In 1980, Congress enacted CERCLA (Superfund). CERCLA outlines the responsibility for identifying and remediating contaminated sites in the United States and its possessions. The CERCLA legislation identifies the EPA as the primary policy and enforcement agency regarding contaminated sites.

The 1986 Superfund Amendents and Reauthorization Act (SARA) extends the requirements of CERCLA and modifies CERCLA with respect to goals for remediation and the steps that lead to the selection of a remedial process. Under SARA, technologies that provide permanent removal or destruction of a contaminant are preferable to actions that only contain or isolate the contaminant. SARA also provides for greater interaction with public and state agencies and extends the EPA's role in evaluating health risks associated with contamination. Under SARA, early determination of Applicable or Relevant and Appropriate Requirements (ARARs) is required, and the consideration of potential remediation alternatives is recommended at the initiation of an RI/FS. SARA is the primary legislation governing remedial action at past hazardous waste disposal sites.

Executive Order 12580, adopted in 1987, gave various Federal agencies, including the Department of Defense (DoD), the responsibility to act as lead agencies for conducting investigations and implementing remediation efforts when they are the sole or co-contributor to contamination on or off their properties.

To ensure compliance with CERCLA, its regulations, and Executive Order 12580, the DoD developed the IRP, under the Defense Environmental Restoration Program, to identify potentially contaminated sites, investigate these sites, and evaluate and select remedial actions for potentially contaminated sites. The DoD issued the Defense Environmental Quality Program Policy Memorandum (DEQPPM) 80-6 regarding the IRP program in June 1980, and implemented the policies outlined in this memorandum in December 1980. The NCP was issued by EPA in 1980 to provide guidance on a process by which:

- Contaminant release could be reported;
- Contamination could be identified and quantified; and

- Remedial actions could be selected.

The NCP describes the responsibility of Federal and state governments and those responsible for contaminated releases.

The DoD formally revised and expanded the existing IRP directives and amplified all previous directives and memoranda concerning the IRP through DEQPPM 81-5, dated 11 December 1981. The memorandum was implemented by a U.S. Air Force message dated 21 January 1982.

The IRP is the DoD's primary mechanism for response action on U.S. Air Force Installations affected by the provisions of SARA. In November 1986, in response to SARA and other EPA interim guidance, the U.S. Air Force modified the IRP to provide for an RI/FS program. The IRP was modified so that RI/FS studies could be conducted as parallel activities rather than serial activities. The program now includes ARAR determinations, identification and screening of technologies, and development of alternatives. The IRP may include multiple field activities and pilot studies prior to a detailed final analysis of alternatives. Over the years, requirements of the IRP have been developed and modified to ensure that DoD compliance with Federal laws, such as RCRA, NCP, CERCLA, and SARA, can be met.

2.2 PROJECT PURPOSE AND SCOPE

This FSP for NAS Fort Worth (AFCEE Contract No. F41624-95-D-8002) has been prepared according to the Statement of Work (SOW) Delivery Order 0003. Delivery Order 0003 requests environmental services for the site assessment and site investigation (SA/SI), and site characterization (SC) of a Recreational Vehicle (RV) Family Camping (Fam Camp) Area.

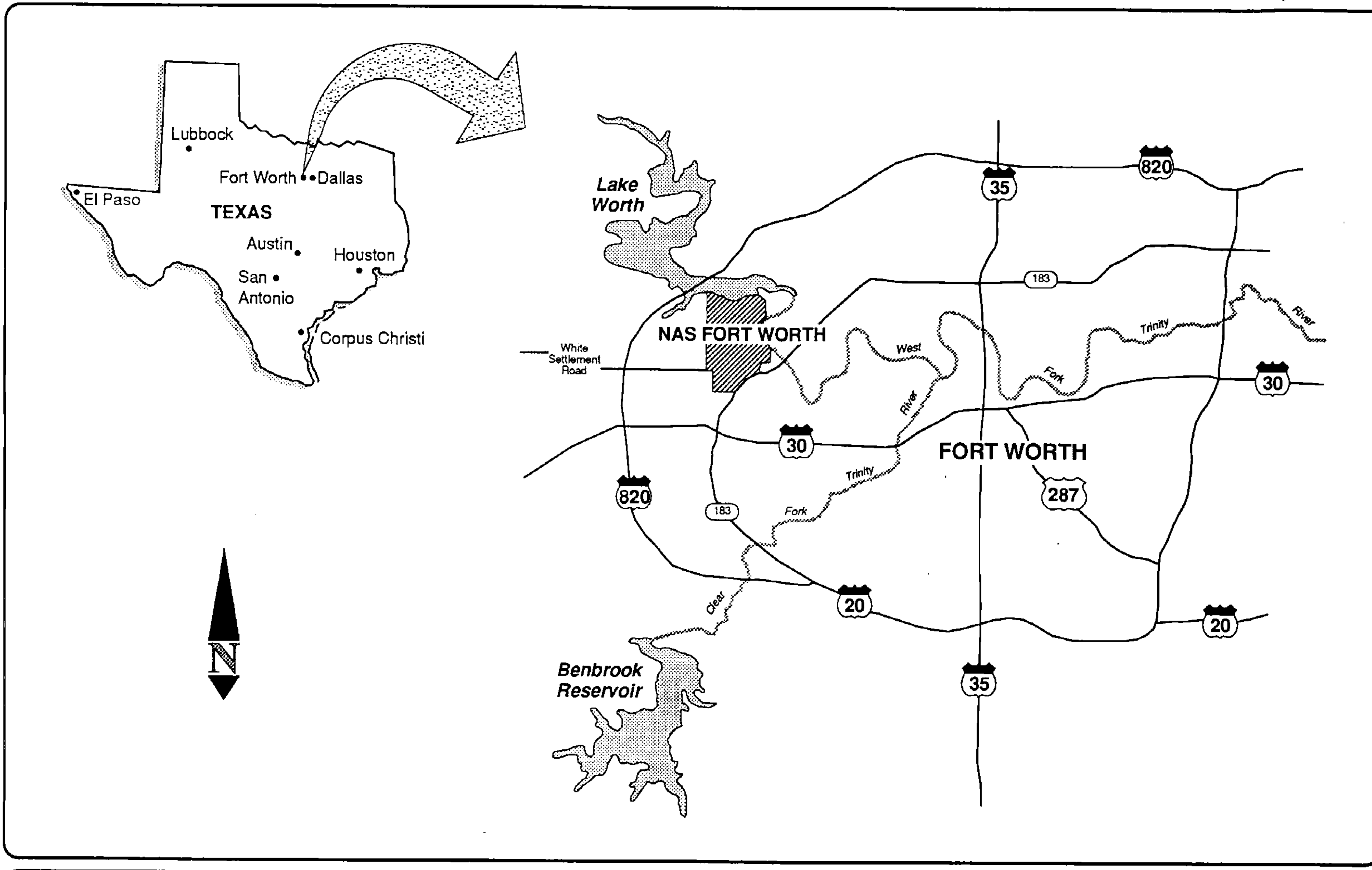
For additional information on project purpose and scope, please refer to the Work Plan for this project.

2.3 PROJECT SITE DESCRIPTION

NAS Fort Worth is located in north-central Texas in Tarrant County, 8 miles west of downtown Forth Worth (Figure 2-1). The base property totals approximately 2,555 acres. The main base comprises 2,264 acres and is bordered to the north by Lake Worth, to the east by the West Fork of the Trinity River and Westworth Village, to the northeast and southeast by Fort Worth, to the west and southwest by the City of White Settlement, and to the west by Air Force Plant 4 (AFP4).

Field work will be performed on two noncontiguous parcels (see Figure 2-2) consisting of:

- The RV Fam Camp Area including the abandoned sewage collection system and associated leachfield; and
- The area in the immediate vicinity of the jet fuel distribution line.



Date 8 May 1996
Project No. P3103
Project Manager G. Metzler
Prepared by EAD
The Environmental Company, Inc.
SOURCE: Radian Corporation 1986

FIGURE 2-1

NAS FORT WORTH LOCATION MAP

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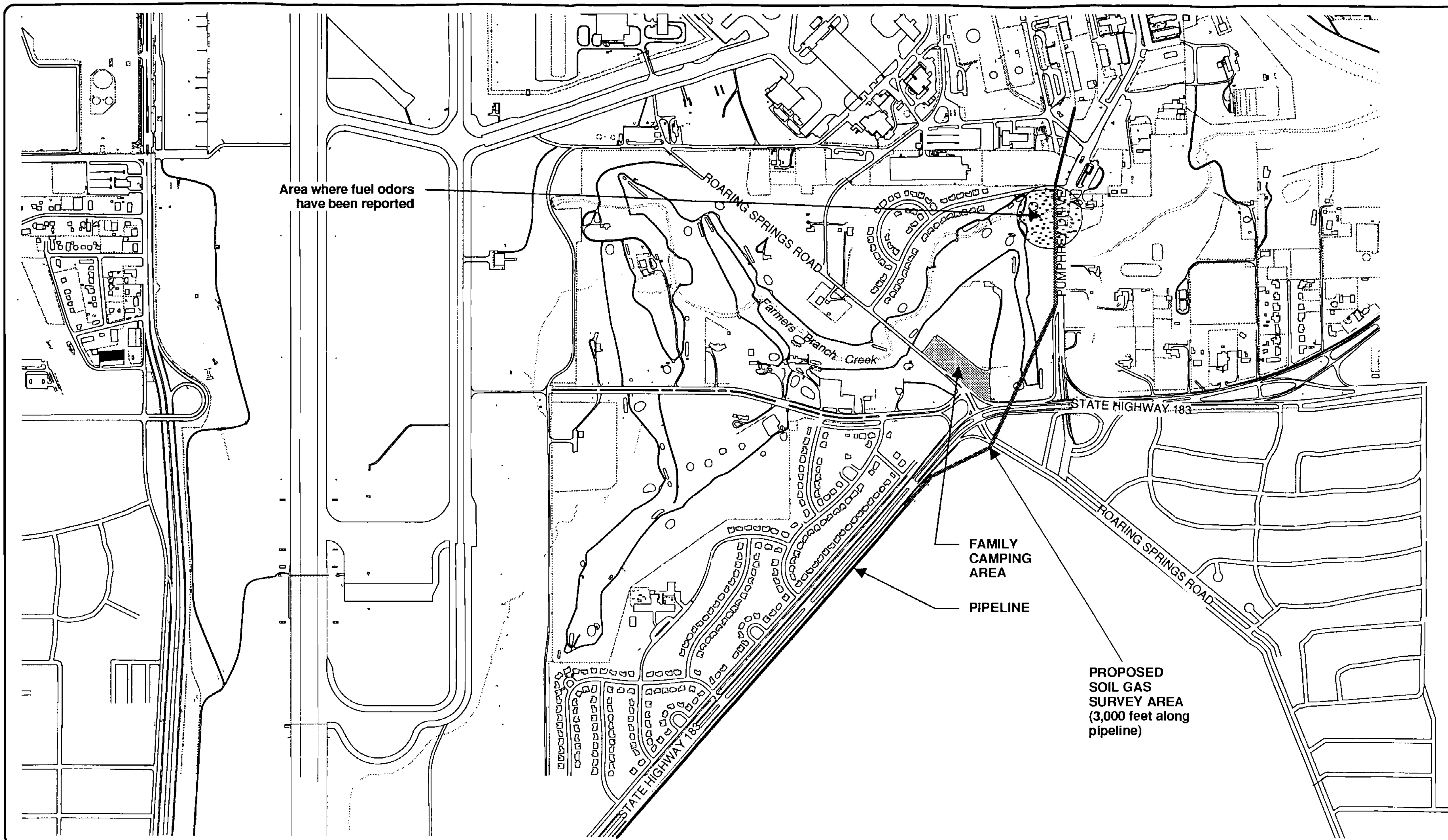

Date July 1996
Project No. P3103
Project Manager G. Metzler
Prepared by EAD
The Environmental Company, Inc.

FIGURE 2-2

NAS FORT WORTH SITE MAP

The area adjacent to the jet fuel distribution line begins at the base near Ascol Drive at the north end of the golf course and continues across the golf course. The jet fuel distribution line exits the base near the intersection of White Settlement Road and State Highway 183. It extends along Highway 183 for approximately 3,000 linear feet to the end of the U.S. Air Force property. Actual property lines and linear footage will be established by a registered land surveyor during SA/SI activities.

2.3.1 Land Uses

Existing land uses in the immediate vicinity of NAS Fort Worth include industrial, commercial, residential, and recreational. Land uses west of the station are primarily industrial as a result of industrial complexes at AFP4 and in White Settlement. South of NAS Fort Worth, commercial enterprises predominate at the interchange of Interstate Highway 30 (I-30) and State Highway 183. Single-family and multi-family residential developments dominate the area southeast of the station, north of I-30, and the area east of the station. The area north of NAS Fort Worth is predominantly composed of recreational and public facilities. Access to the south shore of Lake Worth is restricted due to the presence of NAS Fort Worth and AFP4, but the lake is open to recreation. A fish hatchery, a YMCA camp, and private recreational land are located along the West Fork of the Trinity River. The area surrounding the Off-site Weapons Storage Area is primarily rural, although a residential development is located south of White Settlement Road.

2.3.2 Physiography and Climate

NAS Fort Worth is located within the Grand Prairie section of the Central Lowlands Physiographic Province. The area is characterized by broad terrace surfaces sloping gently eastward, interrupted by westward-facing escarpments. The topography of NAS Fort Worth is fairly flat, except for areas near Farmers Branch and the Trinity River. Elevations average 650 feet above mean sea level (msl) and range from 550 feet above msl in the east to 690 feet above msl in the southwest.

Climate in the Fort Worth area is subhumid with mild winters and hot, humid summers. The average annual precipitation is 31.5 inches with the majority falling between April and October. The average annual temperature is 66 degrees Fahrenheit (°F). July (average annual temperature 86°F) and January (average annual temperature 45°F) are the average hottest and coldest months, respectively. The temperature can fluctuate as much as 20°F to 30°F over several hours. The average annual relative humidity is 63 percent.

Prevailing winds are primarily southerly from March through November and northerly from December through February. The average wind speed is 8 knots. Severe thunderstorms with wind speeds of 65 knots and hailstorms are common. Climate conditions in the summer make tornado formations possible, although there is more property damage attributed to hailstorms than tornadoes.

2.3.3 Hydrogeology

The principal hydrogeologic units underlying NAS Fort Worth include the Terrace Alluvium Aquifer and the Upper, Middle, and Lower Paluxy Aquifers. The Terrace Alluvium Aquifer is the uppermost aquifer and occurs in unconsolidated material and in the underlying Cretaceous-aged Goodland Formation. The unconsolidated material consists primarily of alluvial and fluvial deposits of clay, silt, sand, and gravel. The Goodland Formation is a thinly to massively bedded fossiliferous limestone. The Terrace Alluvium Aquifer is only partially saturated and is not used as a source of drinking water. The Terrace Alluvium Aquifer is recharged by precipitation and leaking water supply lines, sewer lines, and storm drains. Discharge seeps into unnamed streams and into the Trinity River.

The Paluxy Aquifers consist of medium-grained sandstone with interbeds of clays and shales of the Paluxy Formation. The Middle Paluxy Aquifer serves as a water supply source for the community of White Settlement. The Paluxy Aquifers are hydraulically separated from the Terrace Alluvium Aquifer by coquinoid limestone of the Walnut Formation. The Walnut Formation has been subjected to subaerial erosion, suggesting that local hydraulic communication between the Terrace Alluvial Aquifer and the underlying Paluxy Aquifer may have occurred.

2.4 PROJECT SITE CONTAMINATION HISTORY

During 1990, the City of Fort Worth was advancing soil borings in the Farmers Branch Creek area near the main entrance to the base and reported strong fuel odors. Subsequently, Carswell AFB personnel reported these findings to the pipeline owner. The pipeline owner reportedly conducted pressure tests of the pipeline to determine whether the jet fuel distribution line had discharged petroleum product to the environment. Records of the soil borings and pressure tests conducted to confirm these findings are currently unavailable. The AFBCA has requested an investigation of this area to confirm the presence or absence of contamination and to determine its nature and extent if contamination is found. AFBCA has labeled this site on DD Form 1391 as the "RV parking area (RV Fam Camp Area)."

Potential contaminant sources include the jet fuel distribution line and the abandoned leachfield at the RV Fam Camp Area. A second commercial petroleum distribution line is adjacent and parallel to a section of the jet fuel distribution line serving NAS Fort Worth. This second line may also be a potential contaminant source.

The potential exists that a release occurred from one or both of the petroleum distribution lines resulting in adverse impacts to soil and/or groundwater. It is also possible that hazardous substances may have been introduced into the wastewater collection system that is associated with the abandoned leachfield at the RV Fam Camp Area. The RV Fam Camp Area is unsecured as is the area immediately adjacent to State Highway 183. Unauthorized disposal of motor oils, cleaning fluids, and other household-type wastes by individuals using the RV Fam Camp Area may have occurred in the past. Four-inch diameter polyvinyl chloride (PVC) sewer pipe inlets protrude from the ground surface in the RV Fam Camp Area and are highly visible. Contamination of soil and/or groundwater in the abandoned leachfield area may have resulted from unauthorized disposal activities. Potential contaminants include petroleum hydrocarbons and a broad range of other hazardous compounds (e.g., metals, pesticides, polychlorinated biphyenyls).

There have not been investigative activities completed in the project area and there is currently no available documentation regarding background conditions. The RV Fam Camp site is not currently an IRP site.

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3.0 PROJECT DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) are evaluation tools for sampling and analysis activities. They specify data type, quality, quantity, and uses needed to make decisions and serve as the basis for designing data collection activities. DQOs are site-specific, developed during the planning phase, and are documented in the QAPP. They are expressed in terms of precision, accuracy, completeness, representativeness, and comparability. Data collected during the investigation of the RV Fam Camp Area will be used for the following purposes:

- Health and safety monitoring;
- Field screening to assess the potential presence and source of organic contaminants and identify those samples requiring further analysis;
- Site characterization and, if appropriate, preliminary evaluation of remedial alternatives; and
- Risk assessment.

Recordkeeping, field activities, sampling, sample custody, laboratory analyses, and data reduction and validation must be of sufficient scope and detail and taken with sufficient care so that data generated during the course of this project will be legally defensible. DQOs have been prepared following a review of procedures specified in the AFCEE Handbook. The AFCEE Handbook specifies general requirements for conducting all activities on this project so that conditions which jeopardize data quality do not arise.

Geologic and hydrogeologic data will be obtained from the advancement of soil borings and installation of groundwater monitoring wells. The data will be compiled during the SA/SI and SC field investigations to satisfy project-specific DQOs. The DQOs for each type of hydrologic measurement will determine the type of equipment and the relative accuracy and precision required. Tolerances developed by the U.S. Geological Survey (USGS) related to measurements of hydrogeologic data include the following:

Hydrogeologic Measurement	Tolerance
Depth to water with electronic sounder/transducer	+/- 10%
Elevation of measuring points	+/- 0.01 feet
Vertical distance between measuring point and land surface	+/- 0.01 feet
Total depth of all wells	+/- 1%
Depth and length of screened intervals of all wells	+/- 1%
Diameter, casing type, screen type, and method of well construction	Nominal

Hydrologic data to be compiled consists of water level measurements that will be collected during well installation, development, purging, and fit specific time intervals.

As indicated above, field analytical data collected during the SA/SI and SC field investigations will be evaluated in terms of precision, accuracy, representativeness, comparability, and completeness. The following sections briefly discuss how these assessments will be accomplished.

Precision will be evaluated by analyzing matrix spikes, field duplicate samples, determining the Relative Percent Difference (RPD), and comparing the RPD with acceptance criteria presented in the QAPP.

True values for field parameter tests such as pH, specific conductance, and groundwater temperature are not known for specific sampling locations. As such, the accuracy of water parameter screening data produced by field instruments will be maintained and documented by performing proper instrument calibration and maintenance according to manufacturer's instructions.

Procedures presented in this FSP address issues such as collecting groundwater and subsurface soil samples, monitoring pH, specific conductance, and groundwater temperature during monitoring well development and purging, and using dedicated and disposable sampling devices when possible. In addition, representativeness of specific analyses will be achieved by the following means:

- Selecting appropriate number of samples and locations to adequately characterize current site conditions at NAS Fort Worth;
- Using appropriate sampling equipment and analytical procedures;
- Collecting a sufficient number of field quality control (QC) samples to statistically verify proper functioning of the field and analytical programs;
- Documenting sampling activities and sample locations in field logbooks, field forms, and chain-of-custody (COC) forms that are signed and dated by responsible personnel; and
- Using appropriate decontamination techniques for sample and field equipment.

To establish data set comparability, the following steps will be taken:

- Field instruments will be operated within their calibrated range and appropriate analytical methodologies will be used. Analyses will be performed using standard EPA and American Society of Testing and Materials (ASTM) methods.
- The AFCEE-participating laboratory will participate in performance audits.
- Traceable standards will be used by the laboratory.
- Field and laboratory analytical data will be reported in conventional and standard units.

The FSP describes project-specific field procedures for completeness of field-collected samples. Field QC samples including trip blanks, equipment blanks, ambient blanks, and field duplicates will be collected to verify that sampling and decontamination procedures are not inadvertently introducing extraneous contaminants. In addition to field QC samples, geologic data generated during the field investigations will also be reviewed for completeness. For example, logged subsurface soil samples will be examined with a hand lens and shall be identified and described using:

- The Unified Soil Classification System (ASTM D-2467);
- Munsell color charts; and
- Standard geologic descriptions and field tests, including dilantancy, plasticity, grain size and distribution, angularity or roundness percent, mineral content, organic content, and silt-clay-sand percent.

Standard lithologic logging, well installation and completion, data sheets, materials, and sample collection forms will be used to document boring, well installation, and sampling activities. This will also promote comparability of the information collected. Additional geologic and hydrologic information obtained during intrusive activities that may be required to satisfy project DQOs will be documented on standardized forms (see Appendices) and developed for the specific activity (e.g., monitoring well development, purging, sample collection).

3.1 SAMPLE ANALYSIS SUMMARY

A summary of the required number of samples, types of samples, and types of analytical analyses is presented in Table 3-1. Soil and groundwater samples will be obtained from borings and monitoring wells completed in the vicinity of the jet fuel pipeline and RV Fam Camp Area. The RV Fam Camp Area includes individual campsites and the abandoned leachfield.

3.2 FIELD ACTIVITIES

The project objectives of Delivery Order No. 0003 will be to conduct SA/SI and site characterization (SC) field investigations of the area in the vicinity of the RV Fam Camp Area at NAS Fort Worth to confirm the presence or absence of contamination, and to define the nature and extent of contamination if determined to be present.

Following approval of project-scoping documents, TEC will conduct an SA field investigation of the RV Fam Camp area. The objectives of the SA will be to identify potentially contaminated areas and identify areas that may require emergency response. TEC personnel will perform multiple site walks to observe areas of discolored soils, stressed vegetation, and other indicators of potential contamination that may be encountered. Overhead and buried utilities will be located through records search and utilities personnel. A land surveyor will prepare a site base map.

Following completion of the land surveys, TEC will initiate the RV Fam Camp Area Site Investigation (SI). The SI will consist of completing comprehensive soil gas surveys along the jet fuel distribution pipeline and in the RV Fam Area. Passive soil gas monitors will be placed directly above the centerline of the jet fuel distribution line and throughout the RV Fam Camp Area to identify areas of potential soil and groundwater contamination. Prior to installing soil gas monitors along the jet fuel pipeline, TEC will make an effort to locate joints in the pipeline. If joints are located, soil gas monitors will be installed directly above the joints. Joints represent the most likely source areas

Table 3-1 Sample Analysis Summary

SAMPLE ELEMENT	No. of Samples	Number of Analyses							
		VOCs	BTEX	SVOCs	Inorganics	TPH	Pest./ PCBs	TPH Fingerprint	Grain Size
		8240	8020	8270	6010/7470 7471/7421	8015M	8080	GC	ASTM(D422)
Pipeline Soil Boring (SB) Samples	30	10	20	30	10	30		3	5
Pipeline SB Duplicate Samples	3	1	2	3	1	3			
Pipeline SB Trip Blank Samples	2	2				2			
Pipeline SB Ambient Blank Samples	2	2				2			
Pipeline SB Equipment Blank Samples	5	3	3	5	3	5			
RV Fam Camp Area SB Samples	10	10		10	10	10	10		2
RV Fam Camp Area SB Duplicate Samples	1	1		1	1	1	1		
RV Fam Camp Area SB Trip Blank Samples	1	1				1			
RV Fam Camp Area SB Ambient Blank Samples	2	2				2			
RV Fam Camp Area SB Equip. Blank Samples	2	2		2	2	2	2		
Soil Boring Cutting Samples	3								
Devel./Purge Water Samples - New Wells	2	2				2			
Groundwater Samples - New Wells	6	6			3	6			
Groundwater Duplicate Samples	1	1			1	1			
Groundwater Trip Blank Samples	1	1				1			
Groundwater Ambient Blank Samples	1	1				1			
TOTALS	75	45	25	51	31	60	13	3	7

from which petroleum product could have discharged to the environment. Soil gas analyses will target a general fuel hydrocarbon list to include benzene, toluene, ethylbenzene, and xylenes (BTEX), alkanes, and certain semi-volatile organic compounds (SVOCs).

The results of the soil gas survey will be used to develop a Conceptual Site Model (CSM) of the RV Fam Camp Area. The CSM will define the general nature and extent of contamination.

Following a review of SA/SI field data, TEC will initiate the SC field investigation. The purpose of SC data collection, sample collection, and laboratory analysis will be to determine whether contaminants generated from base activities have entered into the environment and pose a risk to human health and/or the environment.

A geophysical subcontractor will be retained to locate and identify the abandoned leachfield. Subsequently, 20 soil borings will be completed in the project area. The soil borings will be located based on soil gas survey results and other areas deemed appropriate and necessary. Since locations will be determined in the field, the locations of soil borings in the project area are not shown in Figure 2-2. Soil borings will be advanced to a depth approximately 5 feet below the encountered groundwater table or refusal, whichever occurs first. Based on preliminary information obtained on the site, it is estimated that depth to groundwater will not exceed 30 feet from ground surface elevation and will be reached prior to encountering bedrock.

During borehole advancement, soil samples will be collected continuously using a split-spoon sampler driven according to ASTM standard D-1586-84. Continuous soil sampling will allow TEC field personnel to evaluate the vertical distribution of contaminants, if encountered. Vertical profiling of contamination will be performed by screening soil samples in the field with an HNU Systems Photo Ionizing Detector (PID).

The results of field headspace screening will also be used to select two soil samples from each boring for laboratory analysis. All soil samples will be analyzed for Total Petroleum Hydrocarbons (TPH), BTEX, or the more comprehensive U.S. EPA Method 8240 analyses to assess volatile organic compound (VOC) contamination. Selected soil samples will be submitted for laboratory analysis of Target Analyte List (TAL) inorganic compounds as a general contaminant scan and to investigate potential contamination from other sources. Grain size analysis will be performed on selected samples to provide data regarding potential contamination migration and remedial options.

Since two petroleum distribution lines and other sources of hydrocarbon contamination are present within the site, additional characterization of hydrocarbon contamination using a hydrocarbon fingerprinting technique will be implemented if petroleum contamination is identified at the site.

Soil samples obtained from borings completed in the vicinity of the abandoned leachfield will be analyzed for TPH, VOCs, SVOCs, pesticides, polychlorinated biphenyls (PCBs), and TAL inorganic compounds. Grain size of soils will also be determined for two samples.

Following sample collection, soil borings will be properly abandoned according to the procedures described in Section 5.5.3. If individual soil borings exhibit evidence of contamination, a groundwater monitoring well will be installed in a separate boring located downgradient of the contaminated borehole. Soil borings completed as monitoring well installations will be advanced without soil sampling. Evidence of contamination will consist of free floating petroleum product, discolored or petroleum-saturated soils, odor-impacted soils, elevated field headspace screening results, and validated laboratory analytical results. TEC anticipates a maximum of six groundwater monitoring well installations. Groundwater monitoring wells will be installed after receipt of unvalidated analytical laboratory data confirming the presence of contamination. Water level measurement and groundwater quality data collected from monitoring wells will allow TEC to evaluate principal groundwater flow directions, hydraulic gradient, and groundwater quality. Installation of 4-inch diameter monitoring wells will also allow for the implementation of remedial measures, if necessary.

The results of the SC field investigation will be used to revise and refine the CSM. Validated data generated during the SC field investigation will be used to conduct an Ecological/Baseline Risk Assessment of the site. Table 3-2 summarizes field activities that will be initiated in the RV Fam Camp Area and along the jet fuel distribution lines.

Table 3-2 Field Activities Summary

Phase	Activity	Number of Tests
SA	Geophysical survey of abandoned leachfield	N/A
SA	Elevation survey	N/A
SI	Soil gas survey	70
SC	Soil boring advancement and completions	20
SC	Soil sampling (two samples per boring)	40
SC	Groundwater monitoring well installations and one round of samples	6

4.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The TEC project team consists of highly qualified professionals with expertise in project management, QA/QC, environmental engineering, field investigations, hydrogeology, data management, risk assessment, and other technical/engineering skills. Responsibilities for key TEC project team and AFCEE/AFBCA POCs are described below.

AFCEE Contracting Officer. The AFCEE Contracting Officer (CO) will be Mr. Jerry Outley. Mr. Outley is located at Brooks AFB, Texas.

AFCEE Contracting Officer's Representative/Team Chief (COR/TC). The AFCEE COR/TC for Delivery Order No. 0003 is Mr. Charles Rice, who is located at Brooks AFB, Texas. As the appointed COR/TC, Mr. Rice shall:

- Be responsible for the technical monitoring of TEC performance and act as the sole technical point of contact (POC) at the AFCEE/ERB;
- Provide technical reviews of TEC's proposals for any changes to Delivery Order No. 0003;
- Coordinate activities with TEC personnel and individuals at NAS Fort Worth, Texas;
- Review invoices/payment vouchers according to Special Contract Requirements provisions of the basic contract;
- Review and accept the completed effort specified in Delivery Order No. 0003;
- Attend meetings as the official government representative; and
- Maintain written records of all actions taken by NAS Fort Worth technical personnel, TEC, and himself for POC review to ensure that costs, schedule, and technical performance are accurately documented.

Base POC/AFBCA Site Manager. The AFBCA Site Manager and Base POC will be Mr. Olen Long, P.E. Mr. Long is located at NAS Fort Worth, Texas. As Site Manager, Mr. Long will provide the following assistance.

- Provide TEC and project subcontractors with existing engineering plans, drawings, and aerial photographs to facilitate evaluation of the IRP site under investigation.
- Arrange for personnel identification badges, vehicle passes, and/or entry permits.
- Provide areas for staging, decontamination, and temporary waste storage. TEC will make every effort to remove waste from NAS Fort Worth in an expedient and cost-effective manner.
- Supply sources of electrical power and water. TEC will be responsible for any utility connections required.
- Provide office space for TEC and project subcontractors during the field investigation.

AFBCA Contracting Officer. The AFBCA contracting officer will be Ms. Randi Audello, who is located at NAS Fort Worth, Texas. Ms. Audello will assist TEC in obtaining required digging permits.

TEC Project Director. The TEC Project Director is Mr. Jack Wilson, P.E. who is located at the TEC corporate headquarters in Charlottesville, Virginia. Mr. Wilson's primary responsibility will be to provide guidance to the TEC Project Manager. Mr. Wilson will perform the following duties:

- Oversee project QA;
- Serve as acting Project Manager in the Project Manager's absence;
- Contact the client on a monthly basis to check on project status and hear the client's perception of the work activity first hand;
- Attend key meetings with the Project Manager and the client as needed;
- Attend key meetings with regulatory officials or other groups involved in the project as needed; and
- Ensure that appropriate corporate resources are being applied to the project.

TEC Project Manager. Mr. Glenn M. Metzler will serve as TEC's Project Manager. Mr. Metzler is located at TEC's corporate headquarters in Charlottesville, Virginia and will have primary responsibility for all management matters that affect the project. The Project Manager will be responsible for all aspects of the day-to-day operation of the project. These responsibilities will include:

- Personnel scheduling;
- Budget tracking and control;
- Client relations;
- Technical direction; and
- Production scheduling.

Mr. Metzler will also be responsible for overall QC and coordinate all activities under this delivery order with Air Force representatives.

TEC Quality Assurance Manager. The TEC QA Manager, Dr. Scott Neese, will ensure that all work is performed according to the procedures described in the SAP. Dr. Neese is located at TEC's corporate headquarters in Charlottesville, Virginia. He will report to Air Force officials and be responsible for all QA issues. In addition, Dr. Neese will review evaluation reports, field and laboratory audits, and corrective actions procedures to ensure that the project meets AFCEE Handbook standards.

TEC Health and Safety Manager. The TEC Health and Safety Manager, Mr. Alistair J. Downie, is located at TEC's corporate headquarters in Charlottesville, Virginia. Mr. Downie will ensure that all field activities are performed according to the approved Health and Safety Plan (HSP) and the provisions of the Occupational Health and Safety Administration (OSHA) 29 CFR 1910.120 for worker health and safety. Mr. Downie will provide assistance, oversight, and senior review of the HSP. The HSP Manager or designee will perform audits to ensure that field work is performed according to the tasks outlined in the FSP.

TEC Field Team Leader. Mr. Metzler will also serve as the TEC Field Team Leader. He will be responsible for ensuring that the SI and SC field investigations are performed in a manner that maximizes data quality while maintaining a safe environment for all field personnel. The TEC Field Team Leader will also be responsible for the following:

- Reviewing all field documentation (e.g., soil borings logs, well completion logs; chain-of-custody forms, monitor well purging forms) for accuracy and completeness;
- Making decisions concerning soil boring, monitoring well, and sample locations;
- Ensuring sample integrity throughout the field investigation; and
- Ensuring that the overall objectives of the field investigation are met according to AFCEE Handbook procedures.

TEC Site Health and Safety Coordinator. The Site Health and Safety Coordinator (SHSC), Mr. David Di Cesare, E.I.T., will be responsible for ensuring that health and safety protocols outlined in the HSP are followed by TEC field personnel. During the SC field investigation, the SHSC or alternate will be responsible for drill rig inspections, personnel monitoring, and personnel protection. The SHSC will also investigate all accidents or injuries related to the project that occur at NAS Fort Worth and will have the authority to stop all work on site if deemed necessary for the protection of field personnel. Furthermore, the SHSC will conduct daily tailgate safety meetings with all field personnel to discuss existing and/or potential site hazards before field activities begin. A detailed discussion of SHSC responsibilities is presented in the HSP.

Figure 4-1 is an organizational chart that identifies all key project personnel. Table 4-1 presents point-of-contact information for key project personnel.

4.1 SUBCONTRACTORS

TEC will serve as the prime contractor for the NAS Fort Worth project. TEC's principal responsibilities will include

- Writing project-specific plans and specifications for various tasks;
- Overseeing subcontractors' work;
- Monitoring subcontractors' compliance with the HSP during all phases of the project;
- Performing air monitoring during various phases of the project; and
- Collecting soil and groundwater samples for laboratory analysis of selected analytical constituents.

FIGURE 4-1

PROJECT ORGANIZATIONAL CHART

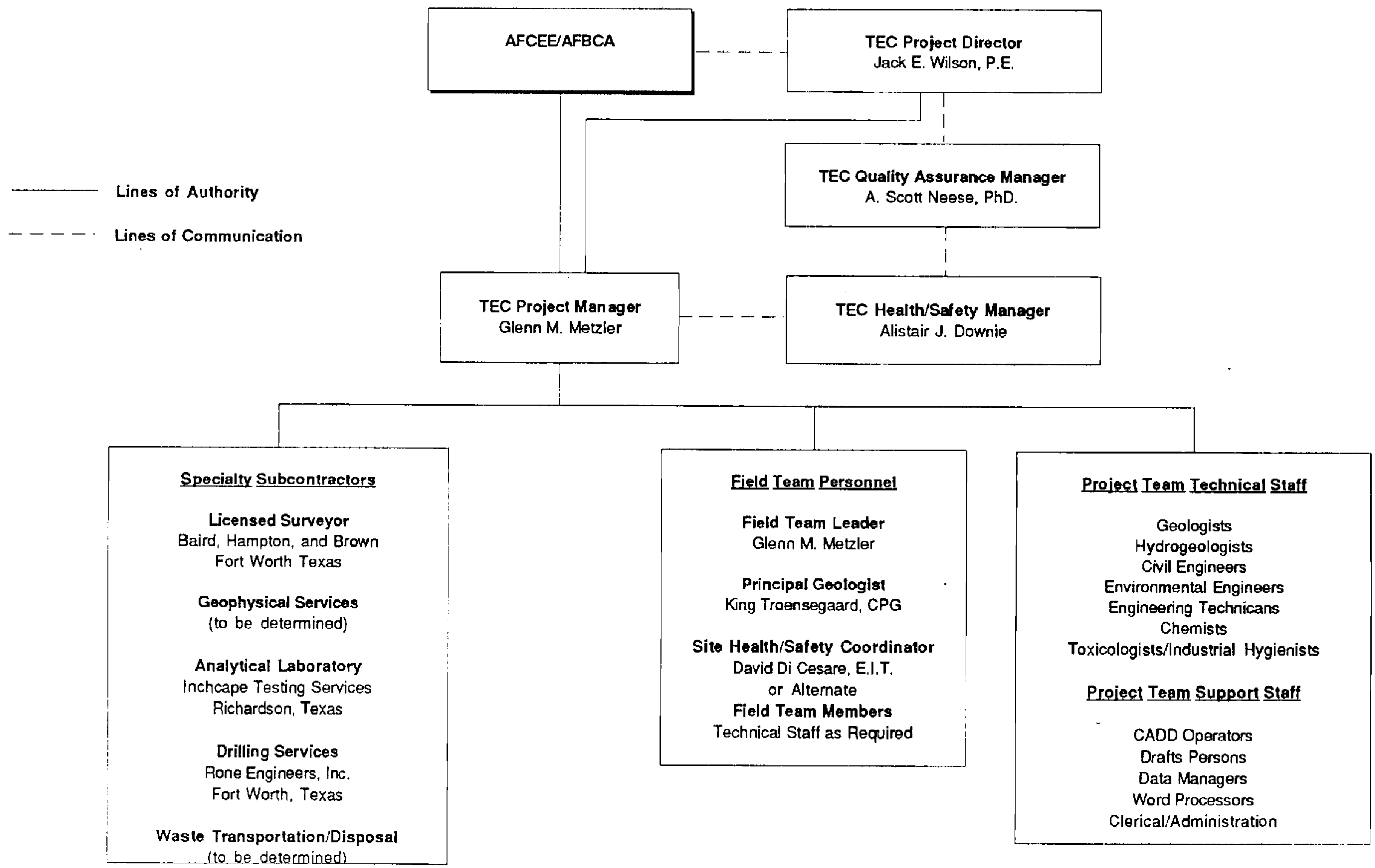

Table 4-1. Key Personnel Point-of-Contact Listing

Mr. Jerry Outley **AFCEE Contracting Officer**	HSC/PKVCC 3207 North Road Brooks AFB, TX 78235-5353 (210) 536-4410 (210) 536-6003 (FAX)
Mr. Charles Rice **AFCEE COR/TC**	AFCEE/ERB 3207 North Road, Bldg. 532 Brooks AFB, TX 78235-5363 (210) 536-6452 (210) 536-3609 (FAX)
Ms. Randi Audello **AFBCA Contracting Officer**	AFBCA/OL-H (Contracting Officer) 6550 White Settlement Road Fort Worth, TX 76114-3520 (817) 731-8284 (817) 731-8137 (FAX)
Mr. Olen Long, P.E. **AFBCA Site Manager/Base POC**	AFBCA/OL-H 6550 White Settlement Road Fort Worth, TX 76114-8137 (817) 731-8284 (817) 731-8137 (FAX)
Mr. Jack E. Wilson, P.E. **TEC Project Director**	The Environmental Company, Inc. 1230 Cedars Court, Suite 100 Post Office Box 5127 Charlottesville, VA 22905 (804) 295-4446 (804) 295-5535 (FAX) JEWILSON@tecinc.com (electronic)
Mr. Glenn M. Metzler **TEC Project Manager**	The Environmental Company, Inc. 1230 Cedars Court, Suite 100 Post Office Box 5127 Charlottesville, VA 22905 (804) 295-4446 (804) 295-5535 (FAX) GMMETZLER@tecinc.com (electronic)

A number of project subcontractors will assist TEC in completing the SA/SI and SC field investigations of the RV Fam Camp Area. Project subcontractors will include the following:

- Drillers;
- Land surveyors;
- Surface geophysics;
- Utility locator;
- Off-site analytical laboratory;
- Investigative-derived waste transporter/disposal contractors; and
- Site restoration contractors.

Figure 4-1 identifies key subcontractors. Responsibilities for each of the project team subcontractors are described below. Prior to initiating field activities, TEC will prepare technical SOWs for project subcontractors so that SA/SI and SC activities can be effectively coordinated.

4.1.1 Drilling Services

During the SC field investigation, Rone Engineers, Inc. (Rone) of Fort Worth, Texas will advance 20 soil borings in the project area. As indicated in Section 3.2, up to six soil groundwater monitoring wells may be installed to evaluate groundwater flow and quality conditions. During soil boring advancement, Rone will collect soil samples continuously from the ground surface using a 2-inch outside diameter (OD) split-spoon sampler driven according to ASTM Standard D-1586-84. Each soil boring will be advanced to an approximate depth of 5 feet below the encountered groundwater table or refusal, whichever occurs first. Advancing the borehole to this depth will allow TEC to identify contamination present. It is anticipated that the primary site contaminants will be petroleum products. The driller will observe all health and safety and equipment decontamination procedures that are described in the HSP and FSP.

4.1.2 Surface Geophysics

A combination of appropriate surface geophysical survey methods such as electrical resistivity (ER), electromagnetics, and/or magnetometry will be used to identify and locate the abandoned leachfield. If necessary, geophysical surveys will also be used to confirm the location of the jet fuel distribution line. The results of the geophysical surveys will be included in the technical summary report. The technical report will include but not be limited to location data, instrumentation, calibration procedures, geophysical interpretations, and maps for all geophysical surveys. The geophysical survey contractor will coordinate geophysical field activities and ensure that geophysical data obtained from the project area is accurate and representative.

4.1.3 Surveying Services

Land surveying services will be performed by Baird, Hampton, & Brown, Inc. (BHB) of Fort Worth, Texas. BHB was selected by TEC on the basis of client preference, technical capability, as evidenced by previous surveying services completed at NAS Fort Worth, and a competitive rate structure. During site reconnaissance, a registered land surveyor (RLS) from BHB will conduct a historical records review and identify existing easements, property boundaries, and adjacent landowners. The RLS will also locate all off-base drilling easements, off-base wells, property lines, and utility locations. This information will be plotted on updated site maps and project plans. All surveying will be performed according to general requirements described in the AFCEE Handbook and Section 5.11 of this FSP. Mr. Daniel Joslin of BHB will oversee surveying activities at NAS Fort Worth.

4.1.4 Analytical Laboratory Services

TEC has selected Inchcape Testing Services (Inchcape) of Richardson, Texas to perform analytical laboratory services. As an AFCEE-qualified laboratory, Inchcape will perform laboratory analyses and QA/QC procedures according to AFCEE and IRPIMS program protocols.

TEC field personnel will submit soil samples to Inchcape for laboratory analyses of VOCs (U.S. EPA Method 8240), SVOCs (Method 8270), BTEX (Method 8020), TAL metals (Methods 6010 and 7000 series), and TPH (Method 8015). If groundwater monitoring wells are installed, aqueous samples will also be collected and submitted to Inchcape for laboratory analysis of VOCs, BTEX, SVOCs, and TAL metals.

A detailed discussion of laboratory procedures, QA/QC, calibration methods and protocols, and data validation and auditing is presented in the QAPP.

4.1.5 Utility Locator

During the SA/SI, the location of all underground utilities in the project area will be identified. TEC will use base personnel and existing site plans. Before soil borings are advanced, a qualified subcontractor will locate and identify buried site utilities. This subcontractor may be the same subcontractor used to conduct surface geophysical surveys.

4.1.6 Investigative-Derived Waste Transporter

If significant quantities of investigative-derived waste (IDW) (i.e. contaminated soil and groundwater) are generated during the SC field identification, TEC will retain a qualified disposal contractor to remove IDW from the site for disposal at a state-licensed facility. TEC has identified several local area firms who have the capability of handling nonhazardous and hazardous waste. IDW handling procedures are described in Section 5.13.

4.1.7 Site Restoration

If appropriate, TEC will retain a qualified subcontractor to restore field sites to pre-field investigation conditions. Conditions that may require site restoration include heavy equipment usage or drilling activity. TEC will identify qualified site restoration contractors prior to initiating intrusive activities. Site restoration, if required, will be coordinated with the AFBCA Site Manager/Base POC to ensure that restoration is conducted according to facility requirements.

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5.0 FIELD OPERATIONS

TEC will perform or oversee the following field activities:

- Site reconnaissance, preparation, and restoration;
- Surface geophysical surveys to locate and identify the abandoned leachfield;
- Installation of passive soil gas screening modules directly above the centerline of the jet fuel distribution line and in the RV Fam Camp Area to evaluate subsurface soils for the presence or absence of selected VOCs and SVOCs;
- Advancement of 20 soil borings;
- Installation of up to six groundwater monitoring wells; and
- Collection of representative soil and groundwater samples for laboratory analysis of selected analytical constituents.

Associated field activities include lithologic logging and field headspace screening of soil samples, borehole abandonment, equipment calibration, decontamination, maintenance, and handling IDW. The following sections provide detailed procedures to conduct field activities.

5.1 GEOLOGIC STANDARDS

The lithologic descriptions for unconsolidated materials (soils [engineering usage] or deposits) shall use the name of the predominant particle size (e.g., silt, fine sand, clay). The dimensions of the predominant and secondary sizes shall be recorded using the metric system. The grain size and name of the deposit shall be accompanied by the predominant mineral content, accessory minerals, color, particle angularity, and any other characteristics. The clastic deposit descriptions shall include, as a supplement, symbols of the Unified Soil Classification System (USCS). The color descriptions shall be designated by the Munsell Color System.

Columnar sections, well and boring logs, well construction diagrams, cross sections, and three-dimensional (3-D) diagrams shall use patterns shown in Figure 5-1. Supplementary patterns shall follow Swanson, R. G., 1981, *Sample Examination Manual*, American Association of Petroleum Geologists, pp. IV-41 and 43.

The scales for maps, geologic cross-sections, or 3-D diagrams shall be selected in accordance with the geologic and hydrologic complexity of the area and the purposes of the illustrations. When geophysical survey data is superimposed on geologic logs, cross sections, or 3-D diagrams, the scales shall be the same. If defining geological conditions requires other scales, additional logs at those scales shall be provided.

For orientation, geologic cross-sections shall show the northern end on the viewer's right. If the line of cross section is predominantly east-west, the eastern end is on the right. Maps shall be oriented with north toward the top, unless the shape of the area dictates otherwise. Orientation will be indicated with a north arrow.

Figure 5-1. Lithologic Patterns for Illustration

Sediments and Sedimentary Rocks

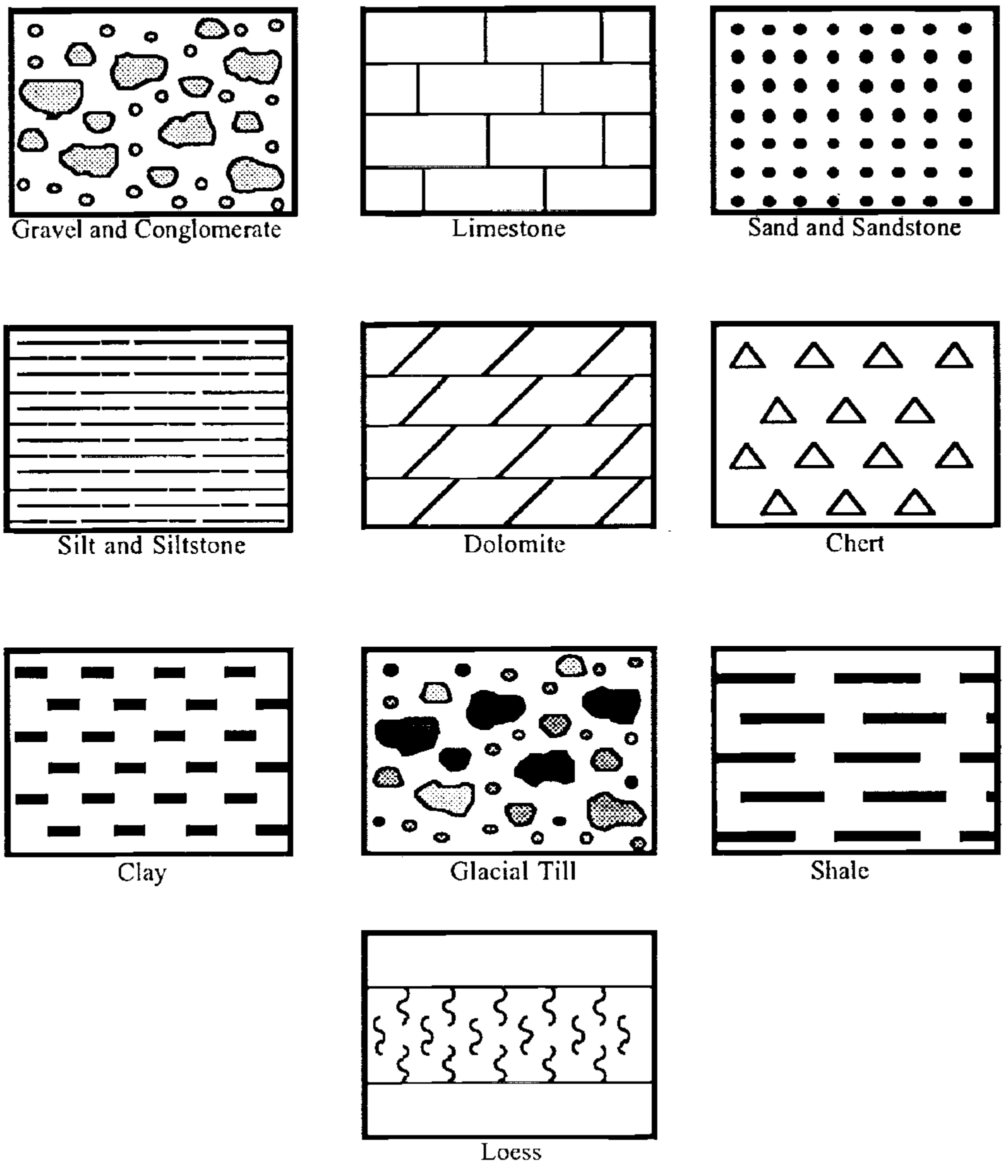
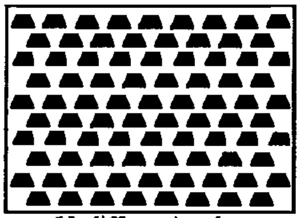
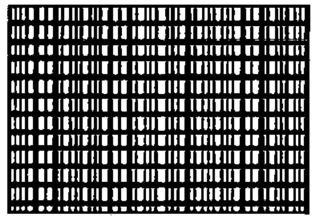


Figure 5-1 (Continued). Lithologic Patterns for Illustration

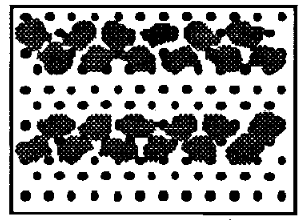
Igneous Rocks



Undifferentiated Intrusive

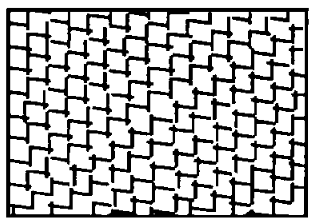


Basalt



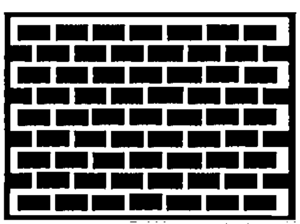
Volcanic Breccia and Tuff

Metamorphic Rocks

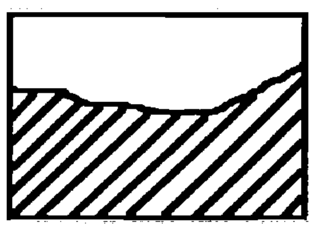


Undifferentiated

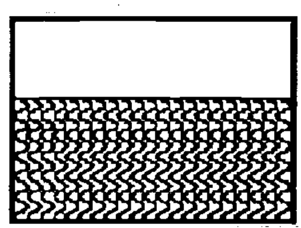
Miscellaneous



Fill



Undifferentiated Bedrock



Residium

5.2 SITE RECONNAISSANCE, PREPARATION, AND RESTORATION PROCEDURES

Prior to the start of sampling activities, TEC will conduct a site reconnaissance of the RV Fam Camp Area. The primary objectives of conducting a site reconnaissance will be to recommend possible changes in the technical approach based on existing field conditions at the time field work is to be undertaken and allow for adequate review of any such changes.

5.2.1 Site Reconnaissance

During the site reconnaissance, TEC will perform the following tasks:

- Review pertinent base documents;
- Interview base personnel who may be knowledgeable about environmental conditions in the project area;
- Conduct multiple site walks to evaluate monitoring and sampling locations;
- Verify and mark proposed sampling locations;
- Evaluate site accessibility and security;
- Designate field office sites;
- Visually identify potentially contaminated areas (i.e., discolored soils, stressed vegetation), particularly those that may require emergency response; and
- Document and evaluate site reconnaissance observations and update site maps.

5.2.2 Preparation

During the SA/SI, TEC will complete a number of site preparation tasks prior to initiating field activities. These tasks will include:

- Familization with Air Force rules, policies, procedures, names of local POCs, and emergency telephone numbers;
- Verifying the location of emergency equipment; and
- Establishing field and communications facilities for TEC field personnel.

TEC will coordinate with all facilities management personnel all activities associated with identifying the jet fuel distribution line and buried utilities with the NAS Fort Worth POC. TEC will also complete required digging permits (Air Force Form 103). Areas designated for intrusive sampling (jet fuel distribution line, abandoned leachfield), shall be surveyed for the presence of underground utilities. Preliminary clearance work will be conducted by base personnel or a utility locator subcontractor using utility maps and information generated from previous clearances. Utility locations will be determined and verified in the field using existing utility maps, and a hand-held magnetometer or utility probe. Information obtained from preliminary clearance work will then be used to locate actual or suspected utility locations for reference. Vehicle access routes to sampling locations shall be determined prior to any field activity.

It is anticipated that up to three decontamination pads will be constructed in the project area to decontaminate drilling rigs, drill tools, and sampling equipment. One decontamination pad will be located in the approximate center of the project site while the other two pads will be constructed along the east and west perimeter of the site. Solid wastes shall be collected in 55-gallon drums and subsequently transported to a waste storage area designated by the Air Force. Smaller decontamination areas for personnel and portable equipment shall be provided as necessary. These locations shall include basins or tubs to capture decontamination fluids, which shall be transferred to a large accumulation drum as necessary.

5.2.3 Site Restoration

Each work site or sampling location shall be returned to its original condition when possible. Efforts shall be made to minimize impacts to work sites and sampling locations, particularly those in or near sensitive environments. Following the completion of work at a site, all drums, trash, and other non-investigative IDW shall be properly containerized and stored on site for subsequent off site disposal. Decontamination procedures are described in Section 5.12.

Site restoration will be coordinated with the NAS Fort Worth POC to ensure that site restoration is conducted according to facility requirements. A site restoration subcontractor will be retained by TEC where necessary to restore areas following heavy equipment usage or drilling activity.

5.3 GEOPHYSICAL SURVEYS

The following sections describe applicable surface geophysical surveys that will be conducted to locate the abandoned leachfield and, if necessary, confirm the location of the jet fuel distribution line. Specific equipment requirements, calibration procedures, geophysical survey grid patterns, and quality control (QC) procedures will also be discussed.

5.3.1 General Requirements For Geophysical Surveys

General requirements for all geophysical surveys follow:

- TEC shall have a state licensed geologist or engineer to supervise or review the work;
- Final results shall be presented in plan views and cross sections. Contours shall be used where appropriate;
- The interpretation of results shall discuss positive and negative results as well as limitations of the methods and data; and
- The interpretation of the data shall be incorporated into the CSM.

5.3.2 Surface Geophysical Surveys

Surface geophysical techniques include ground penetrating radar (GPR), magnetometry, and electromagnetic (EM) techniques. Previous intrusive investigations completed at NAS Fort Worth by other investigators indicated subsurface conditions that consist of clay and silt underlain by sand and gravel. As such, its appears magnetometry, electrical resistivity, and/or EM are the geophysical techniques that will be most successful. The objectives of these geophysical techniques will be to locate the abandoned leachfield and if necessary, confirm the location of the jet fuel distribution line and other utilities. These geophysical survey techniques can also locate boundaries of suspected or known underground metallic objects or volumes of disturbed soil. They can also detect and map contaminant plumes.

Geophysical survey traverses will be plotted on site maps included in the technical report. The location of proposed geophysical surveys is not presented in the FSP because the location of the abandoned leachfield is currently unknown. However, it is assumed that the leachfield is located within several hundred feet of the campsite area.

Surface geophysical surveys are conducted within predetermined grids defined by transect lines crossing each site or area of interest. The spacing of the grids is determined from the approximate dimensions of the features to be located. Qualified individuals shall conduct the surveys and shall be supervised or their work will be reviewed by a state licensed geologist or state licensed engineer.

Requirements for surface geophysical surveys are:

- Surface survey data (profiles and soundings) shall be correlated with at least one soil boring at the same site as the survey, and
- The location and elevation of at least two points of the geophysical survey grid as well as the findings of the investigation shall be professionally surveyed according to the specifications of Section 5.11.

Location data, instrument numbers, calibration information, geophysical interpretation, and maps for all geophysical surveys shall be stored in project files.

5.3.2.1 Ground Penetrating Radar (GPR)

Not applicable to this delivery order.

5.3.2.2 Magnetometry

Magnetometer surveys measure variations in the Earth's magnetic field. Measurements of the magnetic gradient can be used to locate buried ferrous objects such as tanks, pipelines, and metallic debris.

Magnetometer surveys are conducted using a magnetometer/gradiometer or equivalent equipment (e.g., Geometrics model 856AG® proton precession magnetometer/gradiometer). The magnetometer has two sensors and an electronics package. The magnetometer can collect total field data and vertical gradient data and can discriminate to 0.2 gamma (g) in a total field of 40,000 to 60,000 g. Magnetic readings are stored in memory with the time of day, station numbers, and line numbers of the readings. A base station for magnetic readings is established at the start of each day's measurements. Magnetic readings are collected and recorded in the morning, at noon, and at the end of day to evaluate instrument drift.

5.3.2.3 Electromagnetic Methods

An electromagnetic survey measures the electrical conductivity of a subsurface volume, which is a function of the soil or rock type, porosity/permeability, and fluid content.

The measured values, referred to as terrain conductivity, are obtained without direct ground contact through electromagnetic induction. Data collected during an electromagnetic survey can be used to map the location of buried metallic objects; depth or thickness determinations cannot be made solely by this method. The electromagnetic technique can also detect chemicals or contaminant plumes (e.g., hydrocarbons in high concentrations or other conductive or resistive chemicals).

A ground conductivity meter (e.g., Geonics Ltd. EM-31DL®) is used to obtain terrain conductivity data. The transmitting and receiving coils on this instrument are mounted at the ends of 4-foot tubes that project horizontally from either end of the instrument console. The 8-foot coil separation results in a depth of penetration of approximately 15 to 18 feet. A data logger records quadrature and in-phase data at each measuring station.

5.3.3 Borehole Geophysical Surveys

Not applicable to this delivery order.

5.3.3.1 Electric Logs

Not applicable to this delivery order.

5.3.3.2 Natural Gamma Ray Logs

Not applicable to this delivery order.

5.3.3.3 Caliper Logs

Not applicable to this delivery order.

5.3.3.4 Electrical Resistivity (ER)

ER measures the electrical resistivity of subsurface soil, rock, and groundwater. The ER method requires applying an electrical current into the ground using a pair of surface current electrodes. The resulting potential is measured at the surface as voltage between a second pair of potential electrodes positioned in the vicinity of current flow. The subsurface receptivity is calculated from the separation and geometry of the electrode positions, the applied current, and the measured voltage.

The resistivity of earth materials is inversely proportional to their temperature, permeability, porosity, water content, salinity, and ion exchange. For example, dry sands, gravels, and massive unweathered bedrock exhibit relatively high resistivities while clays, water-saturated sediments, or weathered rock have lower resistivities.

Therefore, ER is a good geophysical technique for mapping the groundwater table; tracing groundwater contaminant plumes; delineating zones of weathered bedrock, fractures or solution cavities; determining depth to bedrock; and locating bedrock and sediment lithologic contacts.

Accordingly, ER is useful for mapping lateral changes in the subsurface. Application of the ER method at waste sites include:

- Locating and mapping contaminant plumes;
- Establishing direction of contaminant flow;
- Defining buried sites by locating trenches, defining trench boundaries, and determining the depths of trenches; and
- Defining natural hydrogeologic conditions such as the depth to water table.

5.4 SOIL GAS SURVEYS

5.4.1 Introduction

A soil gas survey's primary function is to assist in identifying potential source areas for soil and groundwater contamination. Soil gas shall also be used in small source areas to help target soil boring and monitoring well locations. Soil gas sampling networks shall be designed to obtain all necessary information with a minimal expenditure of time and resources. The development of the sampling network shall be based on background information, properties of the vadose zone, and hydrogeologic properties of the project area, as discussed in Sections 2.0 and 3.0. Soil gas sampling procedures are discussed in Section 5.4.2.

Common sampling schemes include grids, transect lines, biased, random, and combinations. The selection of sampling schemes for this site will be a transect line directly over the jet fuel distribution pipeline and a grid over the abandoned leachfield. The type(s) of sampling schemes selected shall be modified dependent on site conditions.

Due to the general lack of site data concerning the presence and location of contaminants, TEC will conduct a comprehensive soil gas survey in the project area. Soil gas analyses will target selected petroleum hydrocarbons such as BTEX, alkanes, and selected SVOCs. The results of the soil gas survey will be used to identify areas of potential soil and groundwater contamination. Soil gas measurement results will also be used to optimize soil boring locations.

5.4.2 Sample Methodology

TEC will use the sorbed contaminant-passive approach to perform the soil gas survey. This method of soil gas sample collection involves sampling over time and collecting a sample on an adsorbent material. This combination provides high sensitivity to VOCs and SVOCs, allows for success on sites with low soil permeability, and minimizes fluctuations in soil gas availability due to changing ambient and subsurface conditions. In addition, unlike active sampling methods, passive soil gas sampling does not disrupt the natural equilibrium of vapors in the subsurface.

TEC will use GORE-SORBER® Passive Sorbent Collection Devices (sorbers) to conduct the soil gas survey. The sorbers are 40 millimeters (mm) long with a 3 mm inside diameter, and contain 40 milligrams (mg) of a suitable granular absorbent material such as Tenax-TA® and carbonaceous resins. These absorbent materials are typically used due to their affinity for a broad range of VOCs and SVOCs. The sorbers are sheathed in the bottom of a vapor-permeable insertion and retrieval cord. This construction is termed a GORE-SORBER® Screening Module. Both the retrieval cord and sorbent container are constructed solely of inert, hydrophobic, microporous GORE-TEX® expanded polytetrafluoroethylene (ePTFE, similar to Teflon®).

The ePTFE membranes are hydrophobic and exclude liquid water. However, they do not retard vapor transfer, thus allowing VOC and SVOC vapors to freely penetrate the screening module and collect on the adsorbent material. This ability to protect the sorbent media from contact with ground and soil pore water without retarding soil vapor diffusion facilitates application of soil vapor screening methods in very low permeability and poorly drained soils.

TEC field personnel will install screening modules at approximately 50-foot intervals directly above the centerline of the jet fuel distribution line (60 total screening modules plus three duplicates). An additional six screening modules (plus one duplicate) will be installed in the vicinity of the abandoned leachfield. Prior to installing passive soil gas screening modules along the jet fuel distribution line, TEC will make an effort to locate joints in the pipeline. If joints are located, the soil gas monitors will be installed directly above the joints.

The soil gas screening modules will be installed by initially advancing a .075 inch to 1-inch diameter pilot hole to an average depth of 2 to 3 feet below ground surface using a slam bar or electric rotary hammer. After the pilot hole is advanced to the desired installation depth, the screening modules will be inserted into the completed pilot holes using a stainless steel insertion rod supplied by the manufacturer. The top of each cord will be fastened to a cork, which will then tamped flush with the ground surface to facilitate retrieval of the module, and to seal the annulus of the pilot hole.

5.4.3 Sample Identification Procedures

Prior to installation, TEC field personnel will assign a field identifier to each sample and after insertion of the sorber, place an identification stake adjacent to each soil gas sample location. These field identifiers will appear on the sample labels, COC forms, field sampling forms, and in any field logbook used by TEC. Because the soil gas screening modules will be entered into the IRPIMS database, IRPIMS-compatible identification numbers will be required. The location of each soil gas screening module will be promptly plotted on the base site map. Pertinent field observations (e.g., location, date and time, weather conditions, soil composition, moisture content, sample depth, and contaminant odors) will be recorded with indelible ink on an ASTM-suggested soil gas sample data sheet (ASTM, 1994). These sheets (Appendix A) will be archived and made available to Air Force personnel upon request.

5.4.4 Sample Handling Procedures

After the screening module has been exposed to contaminant migration in the vadose zone for approximately 14 days, TEC field personnel will locate each screening module, remove the cork, grasp the retrieval cord, and manually pull each module from the ground. Corks will be separated from the modules and discarded.

Following collection, TEC field personnel will carefully reseal the exposed screening modules in their designated shipping vials, promptly fill out COC forms, and place screening modules immediately on ice in insulated coolers supplied by GORE. Trip blanks and water and temperature control blanks, both supplied by GORE, will also be returned with the soil gas screening modules. No preservative, other than cooling to 4° C (37° F) will be used with the soil gas screening modules. To minimize movement and/or potential breakage of sample containers during transport, the samples will be packed with shock-absorbent materials, such as bubble wrap. The coolers will be packed with resealable doublebagged ice packs and sealed with packaging tape. Custody tape will be affixed over the cooler lid to prevent or indicate tampering.

At least three bands of strapping tape will be wrapped completely around the coolers to secure the lids. Each cooler will be labeled "FRAGILE" and "This End Up" and shipped to GORE via overnight carrier according to Department of Transportation (DOT) regulations and procedures. Air bills will be properly completed and copies retained and placed in the project file.

5.4.5 Chain-Of-Custody Record

After collecting screening modules, TEC field personnel will fill out, sign, and date in indelible ink, a COC form. Prior to sample shipment, the TEC field team leader will verify that all COC forms are legible, complete, and accurate. The COC form(s) will then be placed in a resealable plastic bag, and taped to the inside lid of the cooler. COC forms will be completed for every sample and accompany shipment of screening modules to the GORE laboratory in Elkton, Maryland to establish the required documentation to track sample possession from time of collection. The completed COC record will contain the following information:

- Sample or soil gas station identification number;
- Signature of collector(s), sampler(s), or recorder(s) involved in COC;
- Date and time of collection;
- Place of collection;
- Sample type; and
- Inclusive dates of possession.

The laboratory portion of the COC form will be completed by designated laboratory personnel and will contain the following information:

- Name of person receiving the screening module samples;
- Laboratory sample number;
- Date of sample receipt;
- Analyses requested; and
- Remarks concerning sample condition and temperature.

5.4.6 Analytical Laboratory Procedures

When the screening modules arrive at GORE, each cooler will be opened, the temperature of the water temperature blank recorded, samples will be logged, and COC documentation will be reviewed for completeness and accuracy. Samples will then be transferred to a freezer which GORE will keep at minus 15°C until analysis is performed.

Modules will be analyzed at GORE either by thermal desorption or solvent extraction coupled with gas chromatography and mass spectroscopy (GC/MS). Analytical instrumentation consists of Hewlett-Packard 5890 gas chromatographs and 5971A mass selective detectors, as well as Perkin-Elmer ATD-400 automated thermal desorption units. Sample preparation consists of removing the tip from the bottom of the sample module and transferring the exposed sorber to a thermal desorption unit for analysis. Sorbers remain clean and protected from dirt, soil, and groundwater by the insertion/retrieval cord, and do not require further sample preparation. Samples remain frozen until analysis.

5.4.7 Quality Assurance/Quality Control (QA/QC) Measures

A number of quality assurance (QA) measures shall be taken to ensure sample representativeness. They include the following:

- All screening modules will be individually numbered and tracked through manufacturing, field deployment, and analytical procedures;
- Completed modules will be subjected to a 16-hour "bake-out" under a nitrogen blanket in a vacuum oven at 150° C to shipment to the field site;
- Each module will be sealed into a clean glass vial with a Teflon liner and transported to the field site and packed inside of coolers supplied by GORE;
- 5 to 10 percent additional trip blanks will accompany the modules to and from the site; and
- 5 percent of the modules will be installed as duplicates (placed in a separate hole within 1 foot of the original pilot hole).

In addition, internal QA controls include instrument, manufacturing, and method blanks, as well as calibration standards and tuning checks are described in the QAPP.

5.5 BOREHOLE DRILLING, LITHOLOGIC SAMPLING, LOGGING, AND ABANDONMENT

5.5.1 General Drilling Procedures

All drilling activities shall conform with state and local regulations and shall be supervised by a state licensed geologist or state licensed engineer. The drilling contractor shall obtain and pay for all permits, applications, and other documents required by state and local authorities. The location of all borings shall be coordinated in writing with the AFBCA POC before drilling commences.

It is anticipated that each soil boring will be advanced to a depth of approximately 5 feet below the encountered groundwater table or refusal, whichever occurs first. At boring locations where bedrock is encountered prior to reaching the groundwater table, the boring will be properly abandoned according to the procedures discussed in Section 5.5.3.

The drill rig shall be cleaned and decontaminated according to the procedure described in Section 5.12. The drill rig shall not leak any fluids that may enter the borehole or contaminate equipment placed in the hole. The use of rags or absorbent materials to absorb leaking fluids is unacceptable.

Based on a preliminary assessment of subsurface conditions, TEC does not anticipate the use of drilling fluids to advance soil borings. If tightly nested gravelly or cobble zones are encountered which preclude further advancement of the soil boring, water may be used. If water is used, TEC shall notify AFCEE in writing to obtain approval and shall provide chemical analyses of the water.

Lubricants shall not be introduced to mask contaminants. In the event that lubricants are used, TEC shall provide AFCEE project personnel with chemical analyses of all lubricants proposed for downhole use. Chemical detection limits shall be equivalent to those used in analyzing project groundwater samples. Lubricants with constituents that are toxic or that increase, decrease, or mask the target chemical species of the investigation shall not be permitted. TEC shall provide analytical results to AFCEE prior to drilling mobilization.

A log of drilling activities shall be kept in a bound field notebook. Information in the log book shall include location, time on site, personnel and equipment present, down time, materials used, samples collected, measurements taken, and any other observations or information that would be necessary to reconstruct field activities at a later date. All items on the log must be completed, if known.

TEC shall direct the drilling contractor to dispose of all trash, waste grout, cuttings, and drilling fluids. These activities will be coordinated with the AFBCA POC or representative.

Because the primary focus of the drilling program is to identify contaminants that may float on the groundwater table, hollow stem auger (HSA) drilling techniques will be used. The HSA drilling method uses a hollow helical steel drill that is rotated to advance the boring and convey soil cuttings to the surface. HSA auger flights are welded onto steel pipe and a cutter head is attached to the lead (bottom) auger to cut and advance the borehole. Because locating the groundwater table is a primary objective of the SC field investigation, the use of drilling fluids and organic-based lubricants will be avoided, if possible.

The top head drive of the HSA is powered by a truck-mounted engine that mechanically rotates the entire flights of augers. The hollow opening allows insertion of sampling tools (e.g., split-spoon sampler) and well completion materials while the auger flights are in place supporting the borehole.

5.5.2 Logging

The lithology in all boreholes shall be logged. The AFCEE-approved boring log (Appendix B) shall be used for recording the lithologic logging information. Information on the boring log sheet includes borehole location; drilling information; sampling information such as sample intervals, recovery, and blow counts; and sample description information.

Unconsolidated samples for lithologic description shall be obtained continuously to the groundwater table using a 2-inch OD split-spoon sampler driven in accordance with ASTM D-1586-84 for standard penetration tests. Continuous split-spoon soil sampling will be performed so that the vertical distribution of contaminants, if encountered, can be accurately profiled using field headspace screening methods.

Lithologic descriptions of unconsolidated materials encountered in the boreholes shall generally be described in accordance with ASTM D-2488-90 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Descriptive information to be recorded in the field shall include:

- Identification of the predominant particles size and range of particle sizes;
- Percent of gravel, sand, fines, or all three;
- Description of grading and sorting of coarse particles;
- Particle angularity and shape; and
- Maximum particle size or dimension.

Plasticity of fines description include:

- Color using Munsell Color System;
- Moisture (dry, wet, or moist);
- Consistency of fine grained soils;
- Structure of consolidated materials; and
- Cementation (weak, moderate, or strong).

The USCS group symbol shall be used and recorded on the Boring Log. Additional information to be recorded includes the depth to the water table, caving or sloughing of the borehole, changes in drilling rate, depths of laboratory samples, presence of organic materials, and other noteworthy observations or conditions, such as the locations of geologic boundaries.

All soil samples obtained with the split-spoon sampler shall be monitored with a HNU Systems DL-101 PID. The samples shall be handled carefully to minimize the loss of volatiles, and these procedures are described in Section 6.0. Soil cuttings exiting the borehole shall be examined for their hazardous characteristics. Materials shall be containerized in conformance with RCRA and state and local requirements. Waste handling procedures are discussed in Section 5.13.

5.5.3 Abandonment

Boreholes shall be properly abandoned to reduce the potential for fluid migration (cross-contamination) between formations or sampling zones. Borehole abandonment will be completed in accordance with Texas Water Well Drillers Rules (30 Texas Administrative Code Chapter 338.48-338.50) and AFCEE requirements. Each borehole not completed as a groundwater monitoring well will be grouted to ground surface by pumping a mixture of 4 pounds of powdered or granular bentonite, 8 gallons of water, and one 94-pound sack of Type I Portland cement (ASTM C-150). The cement/bentonite grout mixture will be thoroughly mixed using a high shear mixer or paddle and tremied or pumped into the borehole. The bottom of the drill pipe shall always be positioned below the top of the grout seal to prevent caving from overlying materials.

All abandoned boreholes shall be checked 24 to 48 hours after emplacement to determine whether curing is occurring properly. More specific curing specifications may be recommended by the manufacturer and shall be followed. If settling has occurred, a sufficient amount of mud/solid bentonite and/or cement shall be added to fill the borehole to the ground surface. These curing checks and any addition of mud/solid bentonite or cement shall be recorded in the field logbook.

The following checklist outlines standard abandonment procedures:

- Check the well or borehole for debris;
- Remove any dedicated sampling equipment which will interfere with abandonment;
- Measure the total depth of the monitoring well or borehole with a sounding weight and line;
- Fill the length of the well screen with fine sand;
- Use a grout mixer along with a positive displacement pump to deliver the mixture with positive pressure to the bottom of the borehole;
- Use a tremie pipe with a diameter greater than 1 inch to allow for adequate flow of bentonite or neat cement grout;
- Place abandonment materials;
- Sound the borehole at pre-set intervals to fill any large diameter or deep boreholes;
- Cut off all well casing below ground surface; and
- Complete the final sealing of the well or borehole with cement or concrete.

The final step in the abandonment program will be to develop appropriate records and reports. These records will identify the methods of abandonment, materials used, and the quantity and mixed weight of all materials. The records shall clearly establish the location of abandoned monitoring wells and/or soil borings. The Texas-licensed well driller provided by the drilling contractor will file a well completion and plugging report with the Executive Director or designee of the Texas Water Commission within 30 days after well completion or abandonment is complete (30 TAC 338.48(e) on forms supplied by the executive director. Records of abandonment will also be included in the Technical Report.

5.6 MONITORING WELL CONSTRUCTION

During the SC field investigation, TEC will oversee the installation of up to six groundwater monitoring wells at various locations throughout the project area. Well locations will be selected following a review of soil gas and geophysical survey results, field observations, soil sample headspace screening results, and laboratory analytical results. TEC will install 4-inch inside diameter (ID) wells so that remedial measures can be implemented if necessary. The on-site TEC geologist shall supervise monitoring well construction and shall be a state-licensed geologist, hydrogeologist, or geotechnical engineer; or shall be certified by the American Institute of Hydrology, American Institute of Professional Geologists, or the National Ground Water Association as a Certified Ground Water Professional. The supervising geologist shall affix his/her signature and registration/certification seal to as-built well construction diagrams.

Since there is a possibility that floating petroleum products shall be encountered, shallow monitoring wells shall be screened across the water table. The length of the screen shall be such that seasonal water table fluctuations shall not cause water levels to rise above or fall below the screened interval. In addition, the well screen will be positioned such that it does not extend into another water-bearing horizon.

5.6.1 Drilling Requirements

All monitoring well installations shall be completed by a Texas-licensed well installer and conform to state regulations. The drilling contractor shall obtain and pay for all permits, applications, and other documents required by state and local authorities.

The drill rig shall be cleaned and decontaminated according to the guidelines described in Section 5.12. The drill rig shall not leak any fluids that may enter the borehole or contaminate equipment that is placed in the hole. The use of rags or absorbent materials to absorb leaking fluids is unacceptable.

5.6.2 Borehole Requirements

Borehole diameters shall be at least 4 inches larger than the outside diameter of the casing and well screen. For example, the inside diameter of a hollow stem auger shall be at least 4 inches larger than the outside diameter of the casing and well screen.

A completed monitoring well shall be straight and plumb. The monitoring well shall be sufficiently straight to allow passage of pumps or sampling devices. The monitoring well shall be plumb within 1 degree of vertical where the water level is greater than 30 feet below land surface unless otherwise approved by AFCEE. AFCEE may waive a plumbness requirement. Any request for a waiver from straightness or plumbness specifications shall be made, in writing, to AFCEE in advance of mobilization for drilling.

The Boring log (Appendix B) shall document the following information for each boring:

- Boring or well identification (this identification shall be unique, and the contractor is responsible for ensuring that it has not been used previously at the installation.);
- Purpose of boring (e.g., soil sampling, monitoring well);
- Location in relation to a landmark;
- Name of drilling contractor and logger;
- Start and finish dates and times;
- Drilling method;
- Types of drilling fluids and depths at which they were used;
- Diameters of surface casing, casing type, and methods of installation;
- Depth at which saturated conditions were first encountered;
- Lithologic descriptions and depths of lithologic boundaries;
- Sampling-interval depths;
- Zones of caving or heaving;
- Depth at which drilling fluid was lost and the amount lost;

- Changes in drilling fluid properties;
- Drilling rate; and
- Drilling rig reactions, such as chatter, rod drops, and bouncing.

5.6.3 Casing Requirements

The casing requirements that shall be followed are:

- All casing shall be new, unused, and decontaminated according to the specifications of Section 5.12;
- Glue shall not be used to join casing, and casings shall be joined only with compatible welds or couplings (flush-threaded) that shall not interfere with the planned use of the well;
- All PVC shall conform to the ASTM Standard F-480-88A or the National Sanitation Foundation Standard 14 (Plastic Pipe System);
- The casing shall be straight and plumb within the tolerance stated for the borehole; and
- The driller shall cut a notch in the top of the casing to be used as a measuring point for water levels.

TEC will use 4-inch ID flush-threaded Schedule 80 PVC well screen and riser pipe. Installation of 4-inch diameter Schedule 80 PVC pipe in the boreholes will allow accurate measurement of groundwater elevations, principal flow directions, collection of representative groundwater samples, and implementation of remedial measures, if necessary. When the monitoring well is installed, TEC field personnel will inspect PVC well screen and riser pipe for damage and decontaminate PVC piping according to equipment decontamination procedures outlined in Section 5.12. An end cap will be placed at the base of the well screen on the bottom-most section of casing so that sediment buildup can be captured.

5.6.4 Well Screen Requirements

Well screen requirements are:

- All requirements that apply to casing shall also apply to well screen, except for strength requirements;
- Monitoring wells shall not be screened across more than one water-bearing unit;
- Screens shall be factory slotted or wrapped;
- Screen slots shall be sized to prevent 90 percent of the filter pack from entering the well, and for wells where no filter pack is used, the screen slot size shall be selected to retain 60 to 70 percent of the formation materials opposite the screen; and
- The bottom of the screen will be capped, and the cap joined to the screen by threads.

Given current drought conditions in Texas, groundwater monitoring wells will be constructed with a 15-foot-long section of 4-inch ID, 0.02-inch slotted Schedule 80 PVC well screen positioned near the bottom of each soil boring. A 15-foot-long length of well screen should allow sufficient water to enter the well intake, particularly during dry periods, without diluting sample quality. The top of the well screen will be positioned approximately 10 feet above the static ground water table to allow for seasonal water table fluctuations and measurement of free floating petroleum product if encountered. However, if evaluation of subsurface soil conditions indicate the well screen will extend into another water-bearing unit, a 10-foot well screen length will be used.

If the most significant contamination is observed in the vadose zone as evidenced by field headspace screening results, odors, and/or discolored or stained soils, the well screen will be positioned to intersect vadose zone contamination to allow for installation of bioventing and/or soil vapor extraction instrumentation. That portion of the borehole which extends below the bottom of the well screen will be properly backfilled with a bentonite/cement grout.

5.6.5 Annular Space Requirements

The annular space requirements are:

- The annular space shall be filled with a filter pack, a bentonite seal, and casing grout between the well string and the borehole wall,
- Any drilling fluids shall be thinned with potable water of known acceptable quality to a density less than 1.2 g/cm^3 (10 lb/gal) before the annular space is filled, and a mud balance or Marsh Funnel shall be kept on site to allow measurement of drilling fluid density, and
- As the annular space is being filled, the well string shall be centered and suspended such that it does not rest on the bottom of the hole.

5.6.6 Filter Pack Requirements

The filter pack shall consist of clean, chemically inert, and well-rounded silica sand or gravel with less than 2 percent flat particles. Ten-twenty grade sand for the filter pack will be used. The filter pack shall have a grain size distribution and uniformity coefficient compatible with the formation materials and the screen, as described in Chapter 12 of *Ground Water and Wells*, 2nd Edition, 1986. It shall be certified free of contaminants by the vendor.

The filter pack shall extend from the bottom of the borehole to a depth of approximately 2 feet above the top of the well screen. It shall not extend across more than one water-bearing unit. Using the tremie pipe emplacement method, filter pack materials will be poured through a rigid or partially flexible tube or pipe via gravity directly to the interval adjacent to the well screen thus minimizing the potential for bridging. Initially, a 1.5-inch diameter tremie pipe will be positioned so that its end is placed at the bottom of the casing-borehole annulus. The filter pack material will then be poured down the tremie pipe or slurried into the tremie pipe with water. The tremie pipe will be raised periodically so that the filter pack material can fill the annular space around the well screen.

After the filter pack is emplaced, the top of the sand pack shall be sounded to verify its depth during placement. An additional filter pack shall be placed as required to return the level of the pack to 2 feet above the screen.

TEC and the drilling contractor shall record the volume of filter sand emplaced in each monitoring well. Potable water may be used to emplace the filter pack as long as no extraneous contaminants are introduced.

5.6.7 Bentonite Seal Requirements

A 100 percent sodium bentonite seal, at least 2 feet thick, will be emplaced between the underlying filter pack and the overlying casing grout. Bentonite will be introduced as pellets, chips, or as a slurry for deeper wells. If chips or pellets are used, TEC will advise the drilling subcontractor not to use a tremie pipe because the inside of the tremie pipe may become clogged. If bentonite is introduced into the boring thorough a slurry, the bentonite shall be hydrated before placement and shall be installed by pump tremie methods. After emplacement, the bentonite will be allowed to hydrate for a minimum of 1 hour before introducing the casing grout.

For monitoring wells with depths less than 15 feet, TEC may propose alternate sealing methods. Prior approval for any alternate method shall be obtained, in writing, from AFCEE before well construction begins.

TEC shall record the type of bentonite used (e.g., chips, pellets, etc.) along with the quantity of bentonite emplaced in each monitoring well.

5.6.8 Casing Grout Requirements

After allowing the bentonite seal a minimum of 1 hour to hydrate, casing grout shall extend from the top of the bentonite seal to ground surface. Grout used in monitoring well construction should always be lump-free. To ensure a lump-free solution, bentonite should always be added to the water first, followed by cement powder and mixed in the following proportions: 94 pounds of neat Type I Portland or American Petroleum Institute Class A cement, not more than 4 pounds of 100 percent sodium bentonite powder, and not more than 8 gallons of potable water. A paddle or shear mixer will be used to prepare the grout for the best consistency. Casing grout shall be pump-tremied using a 1.5-inch diameter side-discharge tremie pipe. Because the newly installed groundwater monitoring wells are anticipated to be relatively shallow (less than 40 feet), it is anticipated that casing grout can be emplaced in one lift. The lift will be allowed to cure a minimum of 24 hours. Subsequently, the TEC on-site supervisory geologist will direct the drilling subcontractor to sound the borehole to determine if the grout has settled. If necessary, additional lifts of casing grout will be pumped into the borehole until the casing grout extends to the ground surface.

TEC and the drilling subcontractor shall record the quantity of grout emplaced in each monitoring well.

5.6.9 Surface Completion Requirements

Ground water monitoring wells will be completed using flush-mounted surface completions. For flush-mounted completions, the PVC well casing will be cut approximately 3 inches below ground surface. A water-tight expandable casing cap will be placed directly over the top of the PVC well casing to minimize surface water from migrating vertically downward along the monitoring well. To allow for the escape of gas, a small diameter (e.g., 0.25-inch) vent hole shall be placed in the upper portion of the casing, or a ventilated well cap shall be used. A freely draining valve box with a locking cover shall be placed over the casing. The top of the casing shall be at least 1 foot above the bottom of the box. The valve box lid shall be centered in a 3-foot diameter, 4-inch thick concrete pad that slopes away from the valve box. The identity of the well shall be permanently marked on the valve box lid and the casing cap. Where heavy traffic may pass over the well or for other reasons, the concrete pad and valve box/lid assembly shall be constructed to meet the strength requirements of surrounding surfaces. A typical flush-mounted monitoring well completion diagram is shown in Figure 5-2.

5.6.10 Piezometer Requirements

Not applicable to this delivery order.

5.6.11 Well Completion Diagrams

A completion diagram (see Appendix C) shall be submitted for each monitoring well installed. It shall include the following information:

- Well identification (this shall be identical to the boring identification described);
- Drilling method;
- Installation date(s);
- Elevations of ground surface and the measuring point notch;
- Total boring depth;
- Lengths and descriptions of the screen and casing;
- Lengths and descriptions of the filter pack, bentonite seal, casing grout, and any backfilled material;
- Elevation of water surface before and immediately after development; and
- Summary of the material penetrated by the boring.

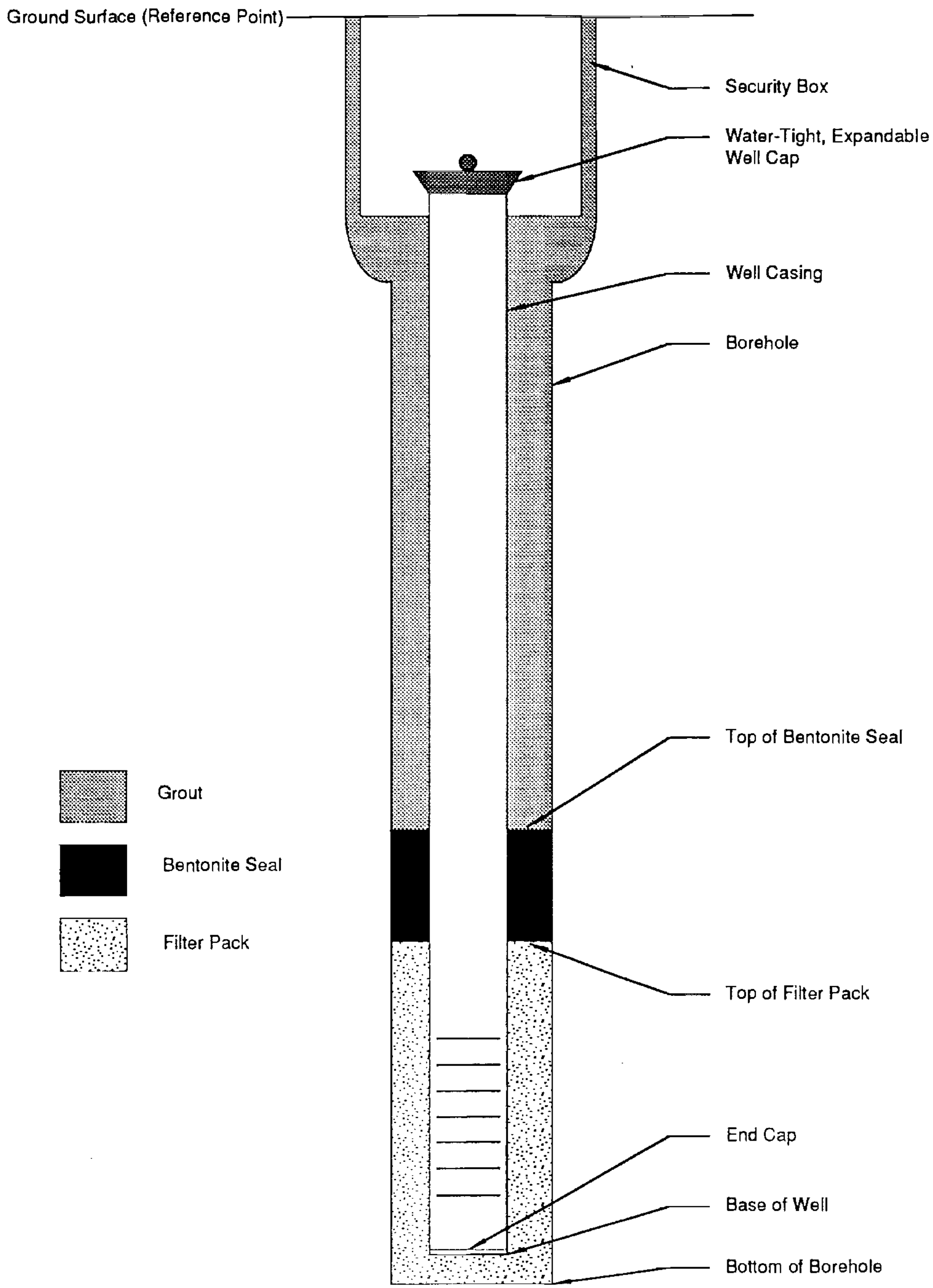
5.6.12 Suction Lysimeters

Not applicable to this delivery order.

5.7 MONITORING WELL DEVELOPMENT

Monitoring well development will be supervised by the TEC site geologist or engineer. General monitoring well development requirements are:

- All newly installed monitoring wells shall be developed no sooner than 24 hours after installation to allow for grout curing;
- All drilling fluids used during well construction shall be removed during development;
- Discharge water color and volume shall be documented;
- No sediment shall remain in the bottom of the well;



Date May 1996

Project No. P3103

Project Manager K. Blackwood

Prepared by EAD

The Environmental Company, Inc.

SOURCE: AFCEE Form WAB.0

NOT TO SCALE

FIGURE 5-2

NAS FORT WORTH
TYPICAL FLUSH-MOUNTED WELL

- No detergents, soaps, acids, bleaches, or other additives shall be used to develop a well;
- All development equipment shall be decontaminated according to the specifications of Section 5.12;
- Wells shall be developed using a bladder pump.

Wells shall be developed until:

- The suspended sediment content of the water is less than 0.75 mL/L, as measured in an Imhoff cone according to method E160.5;
- The turbidity remains within a 10 nephelometric turbidity unit range for at least 30 minutes; and
- The stabilization criteria in Section 6.1.1.1.3 are met,

Initially, the static groundwater level and total well depth will be measured to calculate the volume of groundwater present in the well bore. The volume of groundwater present will be used to determine the amount of groundwater that will be evacuated from each

monitoring well. As indicated above, monitoring wells will be developed using dedicated PVC bailers until stabilization criteria are met. If a slowly recharging well does not recover to 80 percent of its static water level within 6 hours, one well volume will be removed. If a slowly recharging monitoring well recovers to static water level conditions in less than 6 hours, a minimum of two well volumes will be removed. As water is evacuated from the monitoring well, well development water will be screened using a PID, it will be containerized, and then handled according to procedures outlined in 5.13 of this FSP. Physical characteristics such as color, odor, turbidity, and the presence of separate phase product shall be recorded on an AFCEE-approved Well Development Record (Appendix D). In addition, the duration of development, estimated quantities of groundwater removed, and recovery times for wells which are pumped dry will also be noted on the Well Development Record.

5.8 ABANDONING MONITORING WELLS

All abandonment of monitoring wells shall be performed according to state and local laws and regulations. Well abandonment procedures are described in Section 5.5.3.

5.9 AQUIFER TESTS

Not applicable to this delivery order.

5.9.1 Aquifer Testing For Hydraulic Properties

Not applicable to this delivery order.

5.9.1.1 General

Not applicable to this delivery order.

5.9.1.2 Slug Tests

Not applicable to this delivery order.

5.9.1.3 Pumping Tests

Not applicable to this delivery order.

5.9.1.4 Other Test Methods

Not applicable to this delivery order.

5.10 TEST PIT EXCAVATION

Not applicable to this delivery order.

5.11 SURVEYING

5.11.1 General Surveying Requirements

During the site reconnaissance, TEC will retain a registered land surveyor to conduct a historical records review and identify existing easements, property boundaries, and adjacent landowners. The land surveyor will then conduct a site survey so that a base site map can be prepared. The base site map will be used to locate areas of field activity generated during the SA/SI and SC field investigation such as soil gas sampling points, monitoring well locations, soil boring locations, geophysical lines, and other pertinent data. The site base map will also show geomorphic features and man-made structures in the site area. Surveying will have vertical and horizontal accuracies of 0.01 foot and 1 foot, respectively.

All surveying locations of field activities shall be measured by a Texas-registered land surveyor as the distance in feet from a reference location that is tied to the state plane system. The surveys shall be third order (cf. Urquhart, L.C., *1962 Civil Engineering Handbook*, 4th Edition, p. 96 and 97). An XY-coordinate system shall be used to identify locations. The X-coordinate shall be the east-west axis; the Y-coordinate shall be the north-south axis. The reference location is the origin. All surveyed locations shall be reported using the state plane coordinate system. The surveyed control information for all data collection points shall be recorded and displayed in a table. The table shall give the X and Y coordinates in state plane coordinate values, as well as the ground elevation, and the measuring point elevation if the location is a groundwater monitoring well. The elevation of all newly installed flush-mounted groundwater monitoring wells shall be surveyed at the water level measuring point (notch) on the well casing and ground surface.

5.12 EQUIPMENT DECONTAMINATION

All field equipment that may directly or indirectly contact samples shall be decontaminated in a designated decontamination station. Decontamination stations will be established prior to initiating intrusive field activities and consist of a pad on which the portion of the drill rig which stands above the boreholes. The decontamination pads shall be lined with heavy gauge plastic sheeting and designed with a collection system to capture decontamination waters. The drilling rigs and associated drilling equipment will be steam-cleaned between borings to minimize the potential for cross-contamination. Fluids discharged onto the decontamination pad will be allowed to evaporate or recharge site soils.

5.12.1 Heavy Equipment Decontamination

General decontamination procedures for large pieces of equipment include the following:

- Drill rigs will be decontaminated upon entering the site, before leaving the site, or when being moved from one boring location to another;
- Hollow-stem auger flights, drill bits, and rods will be decontaminated with high-pressure hot water and detergent, scrubbed if necessary, and rinsed thoroughly, then allowed to air dry; and
- All casings, screws, and other downhole equipment will be steam-cleaned prior to installation.

5.12.2 Instrument and Reusable Sampling Equipment Decontamination

Instruments such as an electronic water level indicator that contact water will be decontaminated following the procedures for sampling equipment described below. Instruments that are sensitive to soap and solvents such as the pH meter will be rinsed with potable and deionized water. The probes will be cleaned daily and stored overnight according to the manufacturer's recommended procedures.

All reusable field equipment used to collect, handle, or measure samples shall be decontaminated before coming into contact with any soil or groundwater sample. The decontamination procedure must match the degree of contamination of the sampling tool. Brushes and soap may be required to remove dirt from split-spoon samplers. Clean, disposable gloves will be worn during and after decontamination so that equipment will not be recontaminated.

General decontamination procedures for sampling and drilling devices such as split-spoon sampler, bailers, and other equipment that can be hand manipulated are as follows:

- Steam clean if practical.
- Scrub equipment with a solution of potable water and a phosphate-free detergent (i.e., Alconox) to remove all dirt from sampling or drilling item.
- Rinse sampling item thoroughly with copious quantities of potable water to remove residue dirt and rewash if necessary.
- Rinse item with ASTM Type II Reagant Water.
- Rinse item with pesticide-grade methanol to remove residual organics followed by a hexane rinse.
- Prior to reuse, allow item to air dry on a clean surface. The item will be covered with aluminum foil or placed in a closed stainless steel, glass, or Teflon container if it is not immediately reused.

5.13 WASTE HANDLING

5.13.1 General Waste Handling Procedures

Waste handling shall be dealt with on a site-by-site basis. Wastes will be classified as either non-investigative waste or IDW.

Non-investigative-derived waste includes trash, disposable equipment, and clothing. Non-investigative-derived waste will be collected on an as-needed basis to maintain each site in a clean and orderly manner. These wastes shall be placed in plastic garbage bags or sealed boxes and transported to the designated sanitary landfill or collection bin for disposal.

IDW generated during the SA/SI and SC field investigations include:

- Waste soils generated during the field investigations from soil borings and sampling activities;
- Waste water generated on site from monitoring well development and sample purging; and
- Decontamination fluids.

Waste soil and groundwater shall be properly containerized using sealed, U.S. DOT-approved steel 55-gallon drums. Soil cuttings generated from soil borings will be containerized in DOT-approved drums with segregation occurring if VOCs are detected with a PID or if other visual signs of contamination exist. The number of containers shall be determined on an as-needed basis. These drums will be temporarily stored at each soil boring and/or monitoring well installation. IDW shall be segregated at the sample sites according to matrix (solid or liquid) and derivation (soil cuttings, drilling fluid, monitoring well development, and purged groundwater). Each container shall be properly labeled with site identification, sampling point, depth, matrix, constituents of concern, and other pertinent information for handling. These drums will be transported to a fenced area designated by the AFBCA POC.

Decontamination water generated during the field investigations will be minimized using steam cleaners. Water will be contained and allowed to evaporate with excess soil residue placed in a DOT-approved waste soil drum.

Samples of waste soil and groundwater will be collected from each DOT-approved drum, composited, and submitted to the analytical laboratory chosen for analysis of selected analytical constituents. Contamination of IDW by other constituents not specifically tested for will be assessed based on results from soil and groundwater samples collected during the soil borings and monitoring wells, respectively. If analytical results do not detect the presence of constituents above regulatory limits, byproduct waste water will be managed by discharge to an area adjacent to the monitoring well, or discharged to the NAS Fort Worth sewer system after consultation with the AFBCA POC. Waste soils that do not elicit an analytical response will be disposed of as solid waste. If regulatory levels are exceeded, wastes will be handled by properly licensed and approved treatment or disposal facilities.

A Waste Inventory Tracking Form (Appendix E) will be used to document waste handling procedures.

5.14 HYDROGEOLOGICAL CONCEPTUAL MODEL

The TEC project hydrogeologist or engineer will develop a base and site geological and hydrogeological CSM from pre-existing USGS, regional, state, and local studies and information developed during the project. Maps and cross sections shall be used to depict the conceptual model. The CSM shall be the basis for evaluating monitoring well and piezometer locations, and the contaminant distribution (plume delineation).

5.14.1 Analytical or Numerical Model Representations of the Hydrogeological Conceptual Model

Not applicable to this delivery order.

Intentionally Blank.

6.0 ENVIRONMENTAL SAMPLING

The following sections describe methods and procedures that TEC field personnel will use for collecting environmental samples from organic vapors, subsurface soil and groundwater.

6.1 SAMPLING PROCEDURES

All purging and sampling equipment shall be decontaminated according to the specifications in Section 5.12 prior to any sampling activities and shall be protected from contamination until ready for use.

6.1.1 Groundwater Sampling

6.1.1.1 Monitoring Well Sampling

Monitoring wells will be sampled in order of anticipated ascending volatility to minimize the potential for cross contamination between wells. All sampling activities shall be recorded in the field log book. Additionally, all sampling data shall be recorded on a Field Sampling Report (Appendix F).

Before groundwater sampling begins, wells shall be inspected for signs of tampering or other damage. If tampering is suspected, (i.e., casing is damaged, lock or cap is missing) this shall be recorded in the field log book and on the Field Sampling Report (Appendix F), and reported to the TEC supervisory on-site geologist. Wells that are suspected to have been tampered with shall not be sampled until the Project Manager has been informed.

Before the start of sampling activities, plastic sheeting shall be placed on the ground near the well. The plastic sheeting shall be used to provide a clean working area around the wellhead, and prevent any soil contaminants from contacting sampling equipment. Visible water in the protective casing or in the vaults around the well casing will be removed prior to venting and purging. Every time a casing cap is removed to measure water level or to collect a sample, the air in the breathing zone shall be checked with a PID. Similarly, air in the well bore shall be checked for organic vapors with a PID and explosive gases with an explosimeter (if warranted). Procedures in the HSP shall be followed.

Purging and sampling shall be performed in a manner that minimizes aeration in the well bore and agitation of sediments in the monitoring well and adjacent formation. TEC will use micropurge sampling techniques to collect groundwater samples from the monitoring wells. Micropurge sampling techniques involves the use of bladder pumps. Bladder pumps that are used for well development, purging, and sample are inexpensive, easy to use, decontaminate, and maintain. In addition, their use is unlikely to result in cross-contamination of monitoring wells. Dedicated bailers shall not be allowed to free-fall into a groundwater monitoring well during any purging or sampling.

In addition to the information described in Section 8.0, the additional information shall be recorded each time a well is purged and sampled. This information shall be recorded on a Well Purging Form (Appendix G) and encoded in IRPIMS files. The information recorded will include the following:

- Depth to water before and after purging;
- Well bore volume calculation;
- Sounded total depth of the monitoring well;
- The condition of each well, including visual (mirror) survey;
- The thickness of any nonaqueous layer; and
- Field parameters, such as pH, temperature, electrical conductance, and turbidity.

6.1.1.1.1 Water Level Measurement

An interface probe shall be used if a nonconductive floating product layer is suspected in the well. The interface probe shall be used to determine the presence of floating product, if any, prior to measurement of the groundwater level. The groundwater level shall then be measured to the nearest 0.01 foot using an electronic water level indicator. Water levels shall be measured from the notch located at the top of the well casing and recorded on the well sampling form. If well casings are not notched, measurements shall be taken from the north edge of the top of the well casing, and a notch shall be made using a decontaminated metal file.

Following water level measurement, the total depth of the well from the top of the casing shall be determined using a weighted tape or electronic sounder and shall be recorded on the well sampling form. The water level depth shall then be subtracted from the total depth of the well to determine the height of the water column present in the well casing. All water level and total depth measuring devices shall be routinely checked with a tape measure to ensure measurements are accurate.

An AFCEE-approved Monitor Well Static Water Level Form (Appendix H) will be used in the field by TEC personnel to record static water levels in the monitoring wells along with explosimeter and PID readings.

6.1.1.1.2 Purging Prior to Sampling

Purging of monitoring wells is performed to evacuate water that has been stagnant in the well and may not be representative of the aquifer. Well purging shall be accomplished using a bladder pump.

At least three well volumes shall be removed from the well before it is sampled. The well bore volume is defined as the volume of submerged casing and well screen. One well volume can be calculated using the following equation (reference: Ohio EPA Technical Guidance Manual for Hydrogeologic Investigations and Ground Water Monitoring Programs, June 1993):

$$V = H \times F$$

where

V = one well volume

H = the difference between the depth of well and depth to water (feet)

F = factor for volume of one foot section of casing (gallons) from Table 6-1

F can also be calculated from the formula:

$$F = \Pi \ (D/2)^2 \times 7.48 \text{ gal/ft}$$

where

D = the inside diameter of the well casing (feet)

Wells with yields too low to produce three well volumes before the well goes dry shall be purged to dryness.

Table 6-1 Volume of Water in One-Foot Section of Well Casing

Diameter of Casing (inches)	F Factor (gallons)
1.5	0.09
2	0.16
3	0.37
4	0.65
6	1.47

The temperature, pH, EC, and turbidity shall be measured and recorded on an AFCEE-approved Monitor Well Purging Form (Appendix G) after removing each well volume during purging. Water removed from the well during purging shall be containerized. Detailed information concerning IDW is presented in Section 5.13.

6.1.1.1.3 Sample Collection

Samples shall be collected no sooner than 24 hours following monitoring well development. Except as noted below, at least three well volumes shall be removed from the well before it is sampled.

The sample may be collected after three well volumes have been removed and the temperature, pH, and EC have stabilized; and after the water level has recovered to 80 percent of its static level or 16 hours after completion of purging, whichever occurs first. If a monitoring well is bailed or pumped dry before three well volumes can be obtained, the sample shall be collected when a sufficient volume of water has accumulated in the well. Stabilization shall be defined as follows: temperature +/- 1°C, pH +/- 0.1 units, EC +/- 5 percent. If these parameters do not stabilize, the sample shall be collected after six well volumes have been removed, and the anomalous parameters shall be brought to the Field Team Leader's attention. Field equipment shall be calibrated in accordance with the QAPP, Section 5.0 and in Section 7.2 of this FSP.

Before collecting groundwater samples, the TEC sampling team shall don clean, phthalate-free protective gloves. For sample collection, bladder pumps will be used. Samples analyzed for VOCs shall be collected first.

Disposable nylon rope will be used to lower and retrieve the bailers. A new length of nylon rope shall be used for each well, and the rope shall be disposed of following sampling activities. Each bailer shall be equipped with a dedicated stainless-steel or Teflon-coated leader so that the nylon rope shall not contact the water in the well.

If dense non-aqueous phase liquids (DNAPLs) are suspected, a bailer shall be lowered to the bottom of the well before purging. It will then be retrieved and observed for the presence of DNAPLs. Hydrochloric acid shall be added to the VOC sample bottle as a preservative before introducing sample water. The sample shall be collected from the bailer using a slow, controlled pour down the side of a tilted sample vial to minimize volatilization. The sample vial shall be filled until a meniscus is visible and then it shall be immediately sealed. When the sample vial is capped, it shall be inverted and gently tapped to ensure that no air bubbles are present. Vials with trapped air shall be refilled until no bubbles are present. After the containers are sealed, sample degassing may cause bubbles to form; these bubbles shall be left in the container. These samples shall never be composited, homogenized, or filtered.

The pH of preserved samples shall be checked in the field by pouring a small amount of the water sample onto pH paper. The paper shall not touch the sample inside the container. TEC will not check the pH of acidified VOC samples. The preservation checks shall be documented on the chain-of-custody forms. One preserved VOC sample per day per sampling crew shall be checked with pH paper. The sole purpose of this sample is to check the pH of VOC samples, it shall not be submitted for analysis.

All groundwater samples collected for this project will be submitted to the laboratory unfiltered.

Required sample containers, preservation methods, volumes and holding times are given in Section 6.2 and Table 6.2. Sampling equipment shall be decontaminated in accordance with Section 5.12 upon completion of sampling activities.

6.1.1.2 Direct Push Sampling

Not applicable to this delivery order.

Table 6-2 Requirements for Containers, Preservation Techniques, Sample Volumes, and Holding Times

Name	Analytical Methods	Cntnr[a]	Preserv.[b,c]	Minimum Sample Amount	Maximum Holding Time
Hydrogen ion (pH) (W, S)	SW9040/ SW9045	P, G	None required	N/A	Analyze immediately
Conductance	SW9050	P, G	None required	N/A	Analyze immediately
Temperature	E170.1	P, G	None required	N/A	Analyze immediately
Turbidity	E180.1	P, G	4°C	N/A	48 hours
Mercury	SW7470 SW7471	P, G, T	HNO_3 to pH < 2, 4°C	500 mL or 8 ounces	28 days (water and soil)
Metals (except chromium (VI) and mercury)	SW6010A SW6020 and SW-846 AA methods	P, G, T	HNO_3 to pH < 2, 4°C	500 mL or 8 ounces	180 days (water and soil)
Total petroleum hydrocarbons (TPH)-volatile	SW8015 (modified)	G, Teflon-lined septum, T	4°C, HCl to pH < 2	2 x 40 mL or 4 ounces	14 days (water and soil); 7 days if unpreserved by acid
Total petroleum hydrocarbons (TPH)-extractable	SW8015 (modified)	G, amber, T	4°C	1 liter or 8 ounces	7 days until extraction and 40 days after extraction (water); 14 days until extraction and 40 days after extraction (soil)
Volatile aromatics	SW8020A	G, Teflon-lined septum, T	4°C, HCl to pH < 2, 0.008% $Na_2S_2O_3$	2 x 40 mL or 4 ounces	14 days (water and soil); 7 days if unpreserved by acid
Organochlorine pesticides and polychlorinated biphenyls (PCBs)	SW8080A, SW8081,	G, Teflon-lined cap, T	4°C, pH 5–9	1 liter or 8 ounces	7 days until extraction and 40 days after extraction (water); 14 days until extraction and 40 days after extraction (soil)
Semivolatile organics	SW8270B	G, Teflon-lined cap, T	4°C, 0.008% $Na_2S_2O_3$	1 liter or 8 ounces	7 days until extraction and 40 days after extraction (water); 14 days until extraction and 40 days after extraction (soil)

Table 6-2 Continued

Name	Analytical Methods	Cntnr[a]	Preserv.[b,c]	Minimum Sample Amount	Maximum Holding Time
Volatile organics	SW8240B, SW8010B, SW8260A	G, Teflon-lined septum, T	4°C, 0.008% $Na_2S_2O_3$ (HCl to pH < 2 for volatile aromatics by SW8240 and SW8260)[b]	2 x 40 mL or 4 ounces	14 days (water and soil); 7 days if unpreserved by acid

a. Polyethylene (P); glass (G); brass sleeves in the sample barrel, sometimes called California brass (T).
b. No pH adjustment for soil.
c. Preservation with 0.008 percent $Na_2S_2O_3$ is only required when residual chlorine is present.

6.1.2 Subsurface Soil Sampling

Soil samples shall be collected based on odors, discoloration, organic vapor meter readings, and other field observations. Based on the results of these screening parameters, two soil samples will be collected from each boring and submitted to the laboratory for analysis of selected analytical constituents. These analytical constituents are specified in Table 3-1. If split-spoon sample recovery is insufficient to meet minimum sample volume requirements, the sample with the next highest screening result will be submitted. If field headspace screening results do not elicit PID readings above background, TEC field personnel will collect soil samples in the 2-foot intervals directly below and directly above the encountered groundwater table.

6.1.2.1 Split-Spoon Samples

When soil samples are submitted for laboratory analysis, they shall be collected using a stainless steel, continuous drive, split-spoon sampler driven in accordance with ASTM D-1586.

Each time a split-spoon sample is taken, a standard penetration test is performed according to ASTM D-1586-84 "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils." The sample is obtained by driving the sampler a distance of 2 feet into undisturbed soil with a 140-pound hammer free falling a distance of 30 inches. The number of hammer blows are then recorded for each 6 inches of penetration on the drill log (e.g., 5/7/8/10). The standard penetration test result (N) is obtained by adding the middle two blow counts (i.e., 7+8=15 blows per foot) to estimate soil density. The initial 6 inches of penetration are not used to estimate soil density because their primary purpose is to securely seat the split-spoon into the ground. Similarly, the final 6 inches of penetration are not used to estimate soil density because their primary function is to fill the remainder of the split-spoon sampler prior to retrieval.

As soon as the split-spoon is opened, the soils shall be monitored for organic vapors using the PID. Air monitoring results shall be recorded on the boring log and in the field log book. Based on this initial screening, samples will be selected for further analysis.

Split-spoon soil samples selected for VOC analysis shall be placed in appropriate sample containers. These containers shall be completely filled to minimize headspace. The sample containers shall then be affixed with a completed sample label, placed in a plastic bag, and placed in an iced cooler held at a temperature below 4 °C.

Samples collected for other analytical parameters shall be collected concurrently with the VOC samples. Soil chemistry samples not being analyzed for VOCs shall be placed in appropriate sample containers (see Table 6.2). If soil must be composited to provide sufficient sample volume for a particular analysis, the sample shall be composited and homogenized in a stainless-steel bowl using a stainless steel trowel or scoop. The sample shall then be transferred into the appropriate sample container, sealed, labeled, and place in an iced cooler held at a temperature below 4 °C.

6.1.2.2 Field Headspace Screening

Following collection of split-spoon soil samples, headspace screening will be performed in the field using a portable PID on the remaining portions of samples selected on the basis of initial screening. Soil samples collected from the borings will be field screened by filling a precleaned glass jar approximately half full with a soil sample, quickly covering the jar top with aluminum foil, and securing the foil seal with the screw cap. The soil samples will then be vigorously shaken for approximately 30 seconds and allowed to equilibrate a minimum of 15 minutes and a maximum of 2 hours (120 minutes) to a temperature of approximately 25 °C. The jar headspace will then be screened for organic vapors by puncturing the foil seal with the PID probe, inserting the tip to a distance approximately one-half the headspace depth, and recording the highest reading displayed on the instrument meter. The results of field headspace screening will be used to select two samples from each boring for laboratory analysis of selected analytical constituents (see Table 3-1).

All information regarding field headspace screening results, soil texture, density, consistency, and color shall be recorded on soil boring logs.

6.1.2.3 Sampling by Hand Auger

Not applicable to this delivery order.

6.1.2.4 Direct Push Sampling

Not applicable to this delivery order.

6.1.3 Surface Soil Sampling

Not applicable to this delivery order.

6.1.4 Surface Water Sampling

Not applicable to this delivery order.

6.1.5 Sediment Sampling

Not applicable to this delivery order.

6.1.6 Soil Gas Sampling

As indicated in Section 5.4, TEC field personnel will conduct a soil gas survey during the SI to identify areas of potential soil/groundwater contamination along the jet fuel distribution line and in the RV Fam Camp Area. Passive soil gas monitors will be placed directly above the centerline of the jet fuel distribution line at 50-foot intervals. Additional passive monitors will be placed in the area of the abandoned leachfield. Procedures to implement the soil gas survey are discussed in Section 5.4.

6.1.7 Indoor Air Sampling

Not applicable to this delivery order.

6.2 SAMPLE HANDLING

6.2.1 Sample Containers

Sample containers will be purchased precleaned and treated according to EPA specifications for the methods. If sampling containers are reused, they will be decontaminated between uses by EPA-recommended procedures (i.e., EPA 540/R-93/051). Containers shall be stored in clean areas to prevent exposure to fuels, solvents, and other contaminants. Amber glass bottles will be used where glass containers are specified in Table 6-2.

6.2.2 Sample Volumes, Container Types, and Preservation Requirements

Sample volumes, container types, and preservation requirements for the analytical methods performed on AFCEE samples are listed in Table 6-2.

Sample holding time tracking begins with the collection of samples and continues until the analysis is complete. Holding times for methods required routinely for AFCEE work are specified in Table 6-2. **Samples not preserved or analyzed in accordance with these requirements shall be resampled and analyzed, at no additional cost to AFCEE.**

6.2.3 Sample Identification

Samples collected during the SA/SI and SC field investigations will be identified using a coding system to identify each sample collected during the field investigation. This coding system will allow quick and easy retrieval of information concerning a particular sample. Field identifiers will appear on sample labels, COC forms, field sampling forms, and in any field log books used by TEC site geologists. Because samples collected from this project will be put into the IRPIMS database, IRPIMS-compatible identification numbers will be required.

A list of predetermined field identifiers, numbers, locations, dates, and times will be maintained by TEC and made available to Air Force project personnel upon request. Each field identifier will be composed of several components which are described below:

Site ID: A two-letter designation (FC) will be used to identify the Fam Camp Area.

Sample Matrix: A two-letter designation will be used to identify the specific type of sample being taken. The following IRPIMS sampling matrix will be used:

LF	Floating Product	WW	Wastewater
WG	Groundwater	WQ	Water QC Matrix
SO	Soil	GS	Soil Gas

Sample Location: A unique identifier will be used to identify sample station location. This designation may include a monitoring well (MW01), soil boring (SB02), soil gas survey station (SG04), or field QC sample which can be an ambient blank (AB), equipment blank (EB), or trip blank (TB).

Sample Number: A two-digit designation will identify the sequential number of the sample collected at a particular station (e.g., 02 would indicate the second sample collected).

Examples of field identifiers include the following:

- FC-GW-MW02-01 - Fam Camp site - the first round of groundwater sample collected from monitoring well MW02.
- FC-WQ-MW02-01 - Fam Camp site - a water QC matrix sample collected from monitoring well MW02 during the first round of groundwater sampling.
- FC-SB04-SS03 - Fam Camp site - the third soil sample collected from soil boring SB04.
- FC-GS-SG07-01 - Fam Camp site - the seventh soil gas survey station.
- FC-WQ-EB-01 - The first equipment blank sample collected from the Fam Camp Site.

6.3 SAMPLE CUSTODY

Procedures to ensure the custody and integrity of the samples begin at the time of sampling and continue through transport, sample receipt, preparation, analysis and storage, data generation and reporting, and sample disposal. Records concerning the custody and condition of the samples are maintained in field and laboratory records.

TEC shall maintain COC records for all field and field QC samples. A sample is defined as being under a person's custody if any of the following conditions exist:

- It is in their possession,
- It is in their view, after being in their possession,

- It was in their possession and they locked it up, or
- It is in a designated secure area.

All sample containers shall be sealed in a manner that shall prevent or detect tampering. Tape shall not be used to seal sample containers. Samples shall not be packaged with activated carbon unless prior approval is obtained from AFCEE.

The Field Team Leader will be responsible for overseeing and supervising the implementation of proper sample custody procedures in the field. The Field Team Leader is responsible for ensuring sample custody until the samples have been transferred to a courier or directly to the laboratory.

The following minimum information concerning the sample shall be documented on the COC form (see Appendix I):

- Source of samples (including name, location, and sample type) and unique sample identification;
- Date and time of sample collection;
- Designation of Matrix Spike/Matrix Spike Duplicate (MS/MSD);
- Preservative used;
- Analyses required;
- Name of collector(s);
- Pertinent field data (pH, temperature, etc.);
- Serial numbers of custody seals and transportation cases (if used);
- Custody transfer signatures and dates and times of sample transfer from the field to transporters and to the laboratory; and
- Bill of lading or transporter tracking number (if applicable).

All samples shall be uniquely identified, labeled, and documented in the field at the time of collection in accordance with Section 6.2.3 of the FSP. When transferring samples, the individuals relinquishing and receiving will sign, date, and note the time on the COC record. The analytical laboratory will maintain a file copy, and the completed original will be returned to the TEC Project Manager as part of the final analytical report. This record will serve to document sample custody transfer from the sampler to the laboratory.

Samples collected in the field shall be transported to the laboratory or field testing site as expeditiously as possible via overnight courier. Air bills will be retained as part of the permanent documentation and all sample shipments will be regulated by the DOT as described in 49 CFR Parts 171 through 177.

When a 4 °C requirement for preserving the sample is indicated, the samples shall be packed in ice or chemical refrigerant to keep them cool during transportation. During transit, it is not always possible to rigorously control the temperature of the samples. As a general rule, storage at low temperature is the best way to preserve most samples. A temperature blank (a VOC sampling vial filled with tap water) shall be included in every cooler and used to determine the internal temperature of the cooler upon receipt of the cooler at the laboratory.

Once the samples have been received by the laboratory, a file will be maintained of the original documents (e.g., COC forms, special analytical services request form, etc.) pertinent to sample custody and sample analytical protocol.

6.4 FIELD QUALITY CONTROL SAMPLES

During each sampling effort, a number of field QC samples will be collected and submitted for laboratory analyses. The number of QC samples are presented in Table 3-1. A list of QC samples that will be collected and a brief description of each type is outlined in the following sections.

6.4.1 Ambient Blank

Ambient blanks are used to assess the potential introduction of contaminants from ambient sources (e.g., active runways, engine test cells, internal combustion motors in operation) to the samples during collection. During the SC field investigation, ambient blank samples will be collected during the intrusive investigation of the jet fuel distribution line (one per week) from the RV Fam Camp Area (one total), and during sampling of the newly installed groundwater monitoring wells (one total). Ambient blanks shall be collected downwind of any specific VOC sources identified. Since the site is located in a commercial area of the City of Forth Worth, numerous potential sources of airborne contamination are possible

The ambient blank consists of ASTM Type II reagent grade water poured into a VOC sample vial at the sampling site. It is handled like an environmental sample and transported to the laboratory for analysis. Ambient blanks are prepared only when VOC samples are taken and are analyzed only for VOC analytes.

6.4.2 Equipment Blank

An equipment blank is a sample of ASTM Type II reagent grade water poured into or over the decontaminated sampling device or pumped through the sampling device, collected in a sample container, and transported to the laboratory for analysis. Equipment blanks are used to assess the effectiveness of equipment decontamination procedures. Equipment blanks shall be collected immediately after the equipment has been decontaminated. The blank shall be analyzed for all laboratory analyses requested for the environmental samples collected at the site.

A blank sample will be collected once each day during the SC of the jet fuel distribution line and RV Fam Camp Area.

6.4.3 Trip Blank

The trip blank consists of a VOC sample vial filled in the laboratory with ASTM Type II reagent grade water, transported to the sampling site, handled like an environmental sample, and returned to the laboratory for analysis. Trip blanks are not opened in the field. Trip blanks are prepared only when VOC samples are taken and are analyzed only for VOC analytes. Trip blanks are used to assess the potential introduction of contaminants from sample containers or during the transportation and storage procedures. One trip blank shall accompany each cooler of samples sent to the laboratory for analysis of VOCs.

6.4.4 Field Duplicates

A field duplicate sample is a second sample collected at the same location as the original sample. Duplicate samples are collected simultaneously or in immediate succession, using identical recovery techniques, and treated in an identical manner during storage, transportation, and analysis. The sample containers are assigned an identification number in the field such that they cannot be identified (blind duplicate) as duplicate samples by laboratory personnel performing the analysis. Specific locations are designated for collection of field duplicate samples prior to the beginning of sample collection.

Duplicate sample results are used to assess precision of the sample collection process. Precision of soil samples to be analyzed for VOCs is assessed from collocated samples because the compositing process required to obtain uniform samples could result in loss of the compounds of interest.

Ten percent of each sample type and media will be collected in duplicate during the SA/SI and SC soil and groundwater sampling programs. Five percent of the soil gas samples will be collected in duplicate (see Table 3-1).

6.4.5 Field Replicates

Not applicable to this delivery order.

7.0 FIELD MEASUREMENTS

The following sections discuss field measurements, equipment calibration, and maintenance procedures that will be performed during the field investigations. All field measurements will follow procedures in the AFCEE Handbook (Air Force,1993) and equipment operating manuals.

7.1 PARAMETERS

The following sections describe field measurements that will be performed by TEC personnel during drilling and sample collection. Field measurements will be recorded in field log books or on sampling forms.

7.1.1 Organic Vapor Analysis

During borehole advancement and before sampling groundwater monitoring wells, the air in the breathing zone of on-site personnel will be evaluated for the presence of organic (VOCs, SVOCs, petroleum hydrocarbons) and explosive vapors (lower explosive limit and oxygen content) using a HNU Systems DL-101 PID and explosimeter (Industrial Scientific Model MX 251), respectively. Air monitoring data will be tabulated on a Health and Safety Exposure Monitoring Sheet (Appendix J). Procedures provided in the HSP will be followed. In addition to monitoring the breathing zone around the borehole, the HNU PID will be used to screen for organic vapors in the well bore each time a well casing cap is removed and when performing field headspace screening of split-spoon soil samples.

7.1.2 Water Level Measurements

Water level measurements will be taken at the newly installed on-site groundwater monitoring well prior to well development and sample purging. Groundwater levels will be recorded to the nearest 0.01 foot using a Solinst Model 121 Interface Meter. The primary objectives of measuring water levels in the groundwater monitoring wells will be to estimate the volume of water in the well to facilitate well development and sample purging, and to provide a preliminary evaluation of principal groundwater flow directions. The total depth of each groundwater monitoring well will also be measured after installation to evaluate their usefulness for future monitoring.

7.1.3 Immiscible Layer Measurements

The Solinst Model 121 Interface Meter will also be used to monitor the groundwater table for the presence of an immiscible layer such as petroleum product. Depth and thicknesses will be measured to the nearest 0.01 foot.

7.1.4 Electrical Conductance, pH, Temperature, and Turbidity

During well development and sample purging, the above-referenced water quality parameters will be monitored using portable field equipment. TEC anticipates electrical conductance, pH, and groundwater sample temperature will be monitored using a HyDAC Model 910 Water Meter. If another instrument is used, it will be capable of meeting the appropriate QC acceptance criteria. A portable LaMotte Model 2008 Turbidimeter with an accuracy of 2 percent of reading or 0.05 Nephelometric Turbidity Unit (NTU), will be used to facilitate well development.

7.1.5 Ionizing Radiation

TEC will use a hand-held Radalert Nuclear Radiation Monitor to assess background radiation levels during the SA/SI and SC field investigations.

7.1.6 Monitoring Well Elevation and Coordinates

To evaluate principal groundwater flow elevations, directions, and hydraulic gradients, monitoring well elevations and coordinates will be surveyed or determined by a Texas-registered land surveyor.

7.2 EQUIPMENT CALIBRATION AND QUALITY CONTROL

Field equipment will be calibrated according to manufacturer's instrument manuals and the AFCEE IRP Handbook (1993).

7.2.1 Calibration Frequencies

All field instruments will be calibrated on a daily basis if they are used that day, except for the PID which will be calibrated at least twice per day. In some instances, calibration will be performed more frequently. Calibration will provide QA checks on all field equipment used during the implementation of the field investigations. Each instrument will have an individual identification number. This number will be transcribed on field data records when using a particular instrument for a sampling event. All calibration, repair, and service records will be kept in individual equipment log books maintained for each type of instrument. Field equipment that consistently fails to meet calibration standards or exceeds manufacturer's critical limits will be promptly repaired or replaced. TEC will record equipment calibration on a calibration log sheet (Appendix K). Table 7-1 presents a summary of calibration requirements for field instrumentation.

7.2.2 Calibration Procedures

The following are calibration procedures that will be performed during the SA/SI and SC field investigations.

7.2.2.1 Photo Ionizing Detector

The HNU DL-101 PID will be calibrated each day prior to the start of field activities. If the PID is in continuous operation, it will be calibrated at four hour intervals. Instrument calibration will be performed using isobutylene calibration gas of known concentration (100 or 250 ppm). Because the Fort Worth area experiences relatively high ambient humidity conditions, calibration will be performed using a calibration gas humidifier. The calibration gas humidifier consists primarily of a permeable membrane that is placed in-line between the calibration gas canister and the PID probe. Once in place, the standard calibration procedure is followed. The membrane instantaneously equilibrates the calibration gas to ambient humidity conditions. As a result, ambient humidity effects are eliminated. All adjustments to instrument settings will be recorded in a field log book.

Table 7-1. Summary of Calibration and QC Procedures for Screening Methods

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Data Flagging Criteria[b]
SW-846[c]	Moisture	Duplicate sample	1 per 20 samples	% solid RPD £ 15%	Correct problem, repeat measurement. If still out, flag data	J
				RPD > 30%		R
SW9050	Conductance	Calibration with KCl standard	Once per day at beginning of testing	± 5%	If calibration is not achieved, check meter, standards, and probe; recalibrate	R
		Field duplicate	10% of field samples	± 5%	Correct problem, repeat measurement	J
SW9040	pH (water)	2-point calibration with pH buffers	Once per day	± 0.05 pH units for every buffer	If calibration is not achieved, check meter, buffer solutions, and probe; replace if necessary; repeat calibration	R
		pH 7 buffer	At each sample location	± 0.1 pH units	Correct problem, recalibrate	R
		Field duplicate	10% of field samples	± 0.1 pH units	Correct problem, repeat measurement	J
E170.1	Temperature	Field duplicate	10% of field samples	± 1.0°C	Correct problem, repeat measurement	J

Table 7-1. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Data Flagging Criteria[b]
E180.1	Turbidity	Calibration with one formazin standard per instrument range used	Once per day at beginning of testing	± 5 units, 0–100 range; ± 0.5 units, 0–0.2 range; ± 0.2 units, 0–1 range	If calibration is not achieved, check meter; replace if necessary, recalibrate	R
		Field duplicate	10% of field samples	RPD ≤ 20%	Correct problem, repeat measurement	J
None	Org. vapor conc. (FID and PID)	2 point calibration	Monthly	Response ± 20% of expected value	Recalibrate; replace if necessary	R
		Calibration verification and check	Daily at beginning and end of day	Response ± 20% of expected value	Correct problem, recalibrate	R
None	Passive soil gas	See Section 6.2.1 of QAPP	See Section 6.2.1	See Section 6.2.1	Correct problem, repeat measurement	J for field dup; R others
8015 M	Hydrocarbon fingerprint	See Section 6.2.2 of QAPP	See Section 6.2.2	See Section 6.2.2	Correct problem, repeat measurement	R

a. All corrective actions shall be documented, and the records shall be maintained by the prime contractor.

b. All screening results shall first be flagged with an "S" and also any other appropriate validation flags identified in the Data Flagging Criteria column of the table. For example "SJ", "SB", "SR".

c. Described in method SW3550.

7.2.2.2 Interface Meter

Calibration of the Solinst Model 121 Interface Meters is performed by checking the infrared and conductivity circuits. The infrared circuit detects the presence of a liquid while a conductivity circuit differentiates between conductive liquid (water) and nonconductive liquid (NAPL or DNAPL product).

To check the infrared circuit, with the main and probe switches on, insert the cleaning brush into the base of the probe until it reaches the zero measuring point. The zero measuring point is the juncture between the stainless steel body of the probe and the brown Teflon/Delrin base plug. This cuts the infrared beam and activates a steady tone and two lights.

To check the conductivity circuit, with both the main and probe switches on, insert the probe into normal tap water as far as the zero measuring point. This causes a single light and intermittent tone to activate.

The tape is calibrated annually by using a surveyor's steel tape to adjust for stretching of the calibrated line.

7.2.2.3 Electrical Conductivity, pH, Temperature, and Turbidity

Each of these instruments will be calibrated according to the requirements specified in Table 7-1.

The pH function will be calibrated immediately before well development and purging using at least two buffer solutions that bracket the expected pH.

The electrical conductivity function will be calibrated using two solutions of known value that bracket the expected ranges of conductivities.

The calibration of the portable turbidimeter (LaMotte Model 2008) will be evaluated by using two supplied standards within the range of anticipated sample turbidities. These standards have been carefully manufactured and are guaranteed to be accurate within one percent.

7.2.3 Field Quality Assurance/Quality Control Program

To ensure that sampling and monitoring activities will meet DQOs, QC checks will be implemented for parameters measured in the field. All QC control check information will be recorded in project-specific field log books and/or forms. The following sections discuss control parameters, control units, and corrective actions for the field investigation.

7.2.3.1 Control Parameters

Several parameters will be controlled during the field investigations, sampling, and measurement activities. As previously described, calibration of field instruments and operational checks will be conducted periodically. The frequency of field control check duplicates will be a minimum of 10 percent of all field measurements, except for soil gas. As applicable, the materials used to verify control parameter measurements will be from certified sources. Instrument use, maintenance, and calibration will follow manufacturer and AFCEE Handbook guidelines.

7.2.3.2 Control Limits

Control limits are specified in Table 7-1. Field instrument calibration accuracy and duplicate precision for field measurements must meet acceptance criteria, or instrument readings will be considered suspect. Appropriate corrective actions will be taken whenever field instruments fail to meet acceptance for accuracy and precision.

7.2.3.3 Corrective Action

The corrective action required for field instruments used to measure water quality parameters will include recalibrating and remeasuring the parameter. Corrective action for all field instruments will involve a review of the operator's manual. If necessary, instrument maintenance and repairs will be performed as corrective actions in addition to normally scheduled maintenance operations.

7.3 EQUIPMENT MAINTENANCE AND DECONTAMINATION

7.3.1 Equipment Maintenance

Preventative maintenance procedures will be established so that field instrumentation can perform their intended functions. Field instrument maintenance records (Appendix L) will be kept in individual instrument files assigned to each individual instrument.

7.3.2 Maintenance Schedules

Preventative maintenance for field equipment will be performed by manufacturers and TEC field personnel. Maintenance routinely precedes each sampling event. However, some field instrumentation will require scheduled and periodic maintenance and calibration. More extensive maintenance will be performed according to the manufacturer's instructions on the basis of use. To minimize the occurrence of instrument failure or malfunction, preventative maintenance will be scheduled. Examples of the preventative maintenance procedures and schedules for field instruments are described below.

pH-Temperature-Electrical Conductance (HyDAC Model 910 Water Meter). Preventative maintenance for the HyDAC primarily involves the proper care of the electrode. Electrodes will be stored in a 1:1 solution of pH 7 buffer and deionized water. Spare parts such as replacement probes and fresh buffer solutions will be available at all times. For continuous trouble-free operation of the pH meter and combination pH electrodes, annual periodic factory maintenance will be scheduled.

Photo Ionizing Detector (HNU DL-101). Field maintenance procedures are limited to keeping the HNU probe tip and exterior shell clean and the battery charged. Office maintenance includes cleaning the ultraviolet (UV) lamp window with appropriate lens paper, charging the battery overnight, and wiping the exterior of the unit with a damp cloth and mild detergent. At least one backup UV lamp shall be kept in stock along with lamp filters. For continuous trouble-free operation of the HNU PID, annual factory maintenance will be scheduled.

Turbidimeter (LaMotte Model 2008). Periodic maintenance of the turbidimeter is not required. The instrument shall be kept clean and dry, especially the sample chamber. The chamber shall be capped except while inserting or removing the sample tube. The sample chamber should be cleaned with compressed gas. The lamp should be tested for stability prior to initiating field work and replaced at the LaMotte Service Laboratory if necessary. As a rule, AC power should be used if available instead of the battery. If a battery is used, it should be recharged.

Solinst Model 121 Interface Meter. After each use, the tape should be wiped clean and carefully rewound onto the reel. Cleaning the probe entails washing it thoroughly with phosphate-free detergent (Alconox or Liquinox). Clean brushes should be used through the side and base holes to remove any remaining product from the inner areas of the probe. The last steps include scrubbing the bottom pin with steel wool, rinsing the probe thoroughly with distilled water, wiping it dry, then returning it to the holder and turning off both switches. If incorrect signals occur, the probe and reel battery should be changed at the same time using 9 volt Durable MN1604 or Eveready 522 batteries. Batteries should be replaced after approximately 9 to 10 hours; O-rings should be ubricated. Other suitable cleaning methods include hexane and distilled water rinsing and steam cleaning for tape only.

7.3.3 Equipment Decontamination

Decontamination procedures for field and sampling equipment are discussed in detail in Section 5.12. TEC will track decontamination of field equipment with an Equipment Decontamination Log Sheet (Appendix M).

7.4 FIELD MONITORING MEASUREMENTS

7.4.1 Groundwater Level Measurements

Water level measurements shall be taken in all wells to determine the elevation of the water table or piezometric surface at least once within a single 24-hour period. These measurements shall be taken after all wells have been installed and developed and their water levels have recovered completely. Well top elevations will be established by a registered land surveyor. Any conditions that may affect water levels shall be recorded in the field log.

Water level measurements will be taken with a Solinst Model 121 Interface Meter and decontaminated according to the specifications in Section 7.3 and 5.12. Groundwater level shall be measured to the nearest 0.01 foot.

Static water levels shall be recorded each time a well is sampled on a Monitoring Well Static Water Level Form (Appendix H) and before any equipment enters the well. If the casing cap is airtight, time will be allowed prior to measurement for equilibration of pressures after the cap is removed. Water level measurements will be repeated until the water level has stabilized.

7.4.2 Floating Hydrocarbon Measurements

The thickness of hydrocarbons floating in monitoring wells will be measured with the Solinst Interface Meter. Hydrocarbon detection paste, or any other method that may affect water chemistry, shall not be used. When detected, the presence of floating hydrocarbons shall be confirmed by withdrawing a sample with a clear, bottom-fill bailer.

7.4.3 Groundwater Discharge Measurements

Groundwater discharge measurements shall be obtained during monitoring well purging. Groundwater discharges may be measured with orifice meters, containers of known volume, or with in-line meters.

7.5 FIELD PERFORMANCE AND SYSTEM AUDITS

Field performance and system audits include on-site independent evaluations of sample collection, analysis, instrument calibration, measurement, and documentation procedures. Although these audits are qualitative, they can readily evaluate the capability and performance of project personnel, instrumentation, field activities, and project documentation.

Field work and project documentation can be audited by the Quality Assurance Director, Quality Assurance Assistant, or by a designated technical specialist. Each auditor will have the organizational freedom to identify quality problems; to initiate, recommend, or provide solutions to quality problems; and to verify implementation of corrective action. Auditors shall have no direct responsibilities for the technical aspects of the study audited.

The audit program shall be scheduled and implemented to ensure coverage of the applicable elements of the Quality Assurance Program. Audit schedules will be maintained by a regional operation, engineering and environmental program, technical services area, project, or supplier. Audit schedules shall be prepared and maintained for specific projects only if the client funds the audit function.

7.5.1 Audit Frequency

Generic Audits. Generic audits of the TEC Quality Assurance Program will be performed periodically for each engineering or environmental program, technical services area, and/or regional operation. At the request of the Vice President responsible for the office work area, audits shall be performed at a frequency warranted by the results of previous audits. The need for more frequent audits shall be based on the following considerations:

- The importance of the activity to the successful completion of stated corporate objectives;
- Significant changes in the functional areas of the quality assurance program, such as significant reorganization or procedural revisions;
- A suspected nonconformance in an item or service; or
- The necessity to verify implementation of required corrective action.

Project Audit. Audit frequency for projects will be performed as per contractual agreements and as noted in the project Work Plans. Comprehensive audits performed in support of a project may, at the discretion of the Quality Assurance Director, serve to satify the requirements of the generic audit schedule.

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8.0 RECORDKEEPING

8.1 INTRODUCTION

TEC shall maintain field records sufficient to recreate all sampling and measurement activities and to meet all IRPIMS data loading requirements. The requirements listed in this section apply to all measuring and sampling activities. Requirements specific to individual activities are listed in the section that addresses each activity. The information shall be recorded with indelible ink in a permanently bound notebook with sequentially numbered pages. These records shall be archived in an easily accessible form and made available to the Air Force upon request.

The following information shall be recorded for all field activities:

- Location;
- Date and time;
- Identity of people performing activity; and
- Weather conditions.

For field measurements, the numerical value and units of each measurement, and the identity of and calibration results for each field instrument shall also be recorded.

The following additional information shall be recorded for all sampling activities:

- Sample type and sampling method;
- The identity of each sample and depth(s), where applicable, from which it was collected;
- The amount of each sample;
- Sample description (e.g., color, odor, clarity);
- Identification of sampling devices; and
- Identification of conditions that might affect the representativeness of a sample (e.g., refueling operations, damaged casing).

Records shall be kept for all field activities as a means to maintain full documentation of project QA/QC procedures and compliance. In general, all documents will be completed in permanent black ink. Errors will be corrected by crossing them out with a single line and then dating and initialing. The use of correction fluids is not permissible. The documents used during the SA/SI and SC field investigations will remain on site (if possible), during the entire effort so that they can be reviewed by interested parties. Forms will be organized and kept in a central file also located on site, if applicable. Records shall be kept in the form of log books and standardized forms which have been included as appendices to this FSP.

8.2 LOG BOOKS

TEC field personnel will maintain two types of log books. These log books include a Site Log Book and a Field Equipment Log Book. They are briefly discussed in the following section.

8.2.1 Site Log Book

The Site Log Book is the master field investigation document that is a bound book with hard cover and sequentially numbered pages. The primary objective of the Site Log Book is to maintain within one document the actual field data or references to other field documents that contain a specific description of every activity that has occurred in the field on any given day. Any administrative occurrences, conditions, or activities that have affected the field work will be recorded in the Site Log Book.

All field activities entered into the Site Log Book will be signed and dated by the responsible party. The following is a list of the type of information that will be recorded in the Site Log book:

- Name and title of author, date and time of entry, and physical/environmental conditions during the field activity;
- Name and address of field contact;
- Name and titles of field crew;
- Name and titles of all site visitors;
- Documentation of Health and Safety activities;
- Purpose of sampling activity;
- Type of sampled media (e.g., soil, groundwater);
- Sample collection method (e.g., split-spoon, grab, composite, etc.);
- Number and volume of samples taken;
- Description of sampling points;
- Date and time of collection;
- Sample identification numbers;
- Sample distribution (e.g., laboratory);
- References for all maps and photographs of the sample sites;
- Any field measurements made, such as pH, temperature, water level, field headspace screening results;
- Decontamination procedures;
- Instrument calibration;
- Records of telephone conversations; and
- Weather conditions.

8.2.2 Field Equipment Log Book

The purpose of the Field Equipment Log Book will be to document the proper use, maintenance, and calibration of field testing equipment. All equipment will be inspected and approved by the TEC supervisory site geologist prior to use. Calibration log sheets will be maintained for each instrument used on site and shall be kept in the Field

Equipment Log Book. The Field Equipment Log Book or calibration log sheets shall include the following;

- Name and identifying number of the instrument;
- Date calibrated;
- Identification of the calibrator;
- Manufacturer;
- Lot number of any calibration standards;
- Expiration date of calibration standards; and
- Results of calibration.

8.3 Field Data Forms

In addition to the above-referenced logbooks, TEC will complete and maintain standardized field data forms for all field activities. Field data forms have been discussed in the applicable sections of this FSP. These forms are included as appendices to this FSP. They consist of the following:

- Soil Gas Survey Data Sheet (Appendix A);
- Boring Log (Appendix B);
- Well Construction Details and Abandonment Form (Appendix C);
- Well Development Record (Appendix D);
- Waste Inventory Tracking Form (Appendix E);
- Field Sampling Report (Appendix F);
- Monitor Well Purging Form (Appendix G);
- Monitor Well Static Water Level Form (Appendix H);
- Chain-Of-Custody Form (Appendix I);
- Health and Safety Monitoring Sheet (Appendix J);
- Instrument Calibration Log (Appendix K);
- Instrument Maintenance Record (Appendix L); and
- Equipment Decontamination Log Sheet (Appendix M).

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9.0 SITE MANAGEMENT

As indicated in Section 4.0, Mr. Charles Rice will serve as the AFCEE COR while Mr. Olen Long, P.E., will be the AFBCA POC. The following support activities will be provided by AFBCA:

- Issuing digging or appropriate permits before initiating intrusive activities;
- Assisting TEC with obtaining existing engineering plans, drawings, diagrams, aerial photographs, and digitized map files, to facilitate the investigation;
- Arranging for personnel identification badges, vehicle passes, or entry permits;
- Arranging for staging areas for storing equipment and supplies, and providing a large supply of potable water;
- Providing the necessary keys to locks;
- Providing a secure storage area; and
- Providing field office space, as available.

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10.0 VARIANCES

TEC may conclude that a particular field procedure will not provide the required results because of site conditions. If so, the TEC Project Manager will notify the AFCEE TC, Mr. Charles Rice, in writing of the situation and the proposed deviation needed to circumvent the problem and obtain useful data. TEC will not proceed until approval is obtained either verbally or in writing from Mr. Rice or his designee. Verbal approvals will be confirmed in writing and placed in the project file.

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Neilson, David M., 1991, *Practical Handbook of Ground-Water Monitoring.* Lewis Publishers, Inc. Chelsea, Michigan, 717pp.

Ohio EPA. 1993. *Guidance Manual for Hydrogeologic Investigations and Ground Water Monitoring Programs.*

Swanson, R.G. 1981. *Sample Examination Manual.* American Association of Petroleum Geologists.

U.S. EPA. 1993. *Data Quality Objectives for the Superfund.* PB94-963203.

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APPENDIX A
SOIL GAS DATA SHEET

SOIL GAS SAMPLE DATA SHEET

Project No. _______________ Sample No. _________________________

Sampled by: ____

Date Probe Placed: ________________, 199___ Time: _____________(AM/PM)

Date Probe Retrieved: _______________, 199____ Time: _____________(AM/FM)

Sampling System (check one):

( ) Whole air-active approach
( ) Whole air-passive approach
( ) Sorbed contaminants-active approach
( ) Sorbed contaminants-passive approach
( ) Headspace or extraction approach
( ) Soil pore liquid headspace approach

Sample Type (check one)

( ) Direct field sample ( ) Field blank ( ) Travel blank
( ) Sample container blank ( ) Sample probe blank ( ) Sample replicate

Spiked?_____ with _____ cc of _________________________________

Potential reaction products due to spiking_____________________________

System purge volume: ________ Volumes purged: ________ Sample volume: ______

Sorbent device: Installed _____ (AM/PM), ___________, 199__

Recovered _____ (AM/PM), ___________, 199__

Sample container type: ______________ Sample container no. ____________

Surface conditions (pavement, wet, frost, etc.) ___________________________

Sample depth __________ Sampling rate ___________________________

Sample horizon data-visual estimates:

Vadose zone make-up: ( ) Native soil+rock ( ) Fill ( ) Rock

Soil composition

Clay __________%
Silt __________%
Sand _________%
Gravel ________%
100%

Moisture content of sampling horizon (qualitative)

( ) Very (Dry)
( ) Slightly (Damp)
(Moist)
(Wet)

Other characteristics of the sampling horizon:

( ) Free water present ( ) Free product present
( ) Contaminant odors ( ) Indurated
( ) Poor perm. to vapors ( ) Soil discoloration
( ) Near slope or vent ( ) Other

____

Investigator Signature/Date

____

Investigator Affiliation

APPENDIX B
BORING LOG

BORING LOG

Borehole ID: __________
Sheet _____ of ____

Location						
Project Name	Project Number		LTCCODE (IRPIMS)	Site ID	LPRCODE (IRPIMS)	
Drilling Company	Driller		Ground Elevation	Total Drilled Depth		
Drilling Equipment	Drilling Method	Borehole Diameter	Date/Time Drilling Started	Date/Time Total Depth Reached		
Type of Sampling Device			Water Level (bgs) First	Final		
Sample Hammer Type Driving Wt. Drop			Hydrogeologist	Checked by/Date		
Location Description (include sketch in field logbook)						

Depth	Interval	Recovery	Blow Counts	Description (Include lithology, grain size, sorting, angularity, Munsell color name & notation, minerology, bedding, plasticity, density, consistency, etc., as applicable)	USCS Symbol	Lithology	Water Content	Remarks (Include all sample types & depth, odor, organic vapor measurements, etc.)

AFCEE FORM BL0

APPENDIX C

WELL CONSTRUCTION DETAILS AND ABANDONMENT FORM

WELL CONSTRUCTION DETAILS AND ABANDONMENT FORM

FIELD REPRESENTATIVE: ______________________

DRILLING CONTRACTOR: ______________________

DRILLING TECHNIQUE: ______________________
AUGER SIZE AND TYPE: ______________________

BOREHOLE IDENTIFICATION: ______________________
BOREHOLE DIAMETER: ______________________
WELL IDENTIFICATION: ______________________

WELL CONSTRUCTION START DATE: ______________________
WELL CONSTRUCTION COMPLETE DATE: ______________________

SCREEN MATERIAL: ______________________
SCREEN DIAMETER: ______________________
STRATUM-SCREENED INTERVAL (FT): ______________________

CASING MATERIAL: ______________________
CASING DIAMETER: ______________________

TYPE OF FILTER PACK: ______________________
GRADIATION: ______________________
AMOUNT OF FILTER PACK USED: ______________________

TYPE OF BENTONITE: ______________________
AMOUNT BENTONITE USED: ______________________

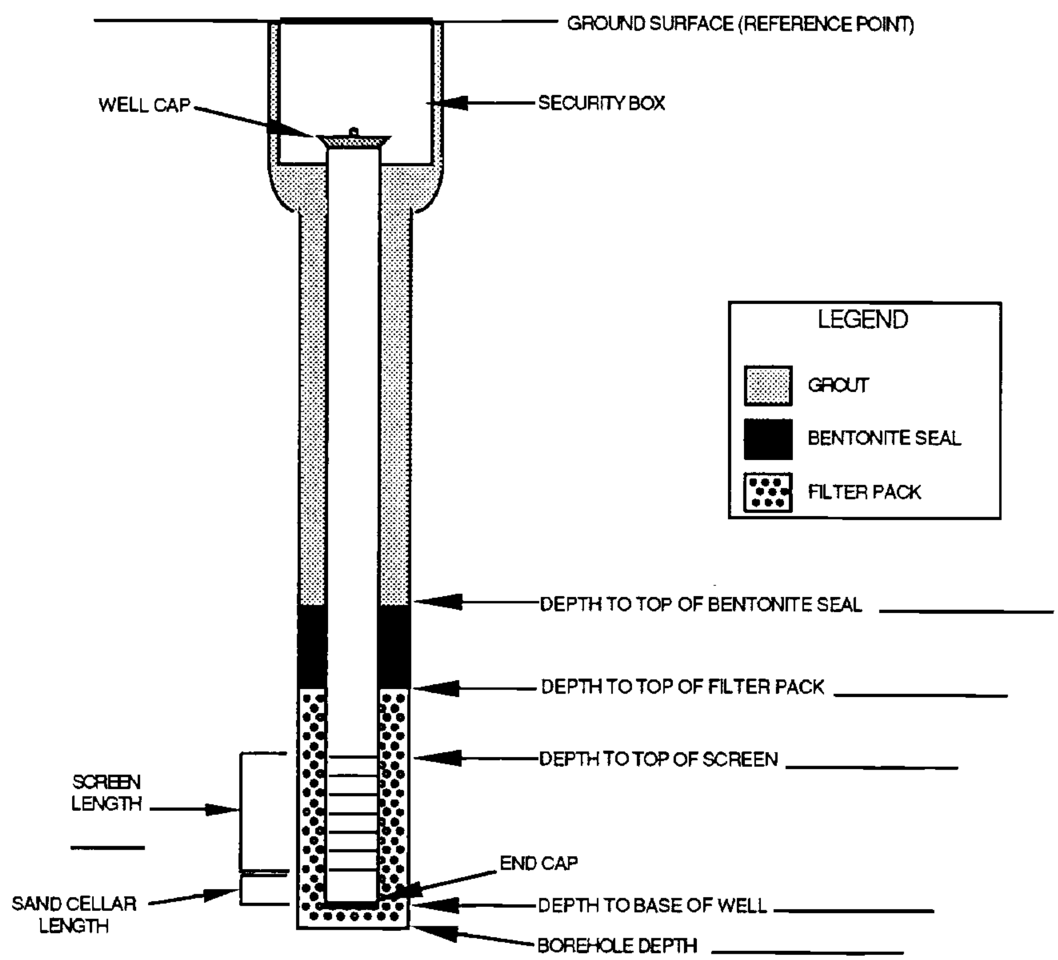
TYPE OF CEMENT: ______________________
AMOUNT CEMENT USED: ______________________
GROUT MATERIALS USED: ______________________

DIMENSIONS OF SECURITY BOX: ______________________

TYPE OF WELL CAP: ______________________
TYPE OF END CAP: ______________________

COMMENTS:

SPECIAL CONDITIONS
(describe and draw)



NOT TO SCALE

INSTALLED BY: ______________________ INSTALLATION OBSERVED BY: ______________________

DISCREPANCIES: ____

APPENDIX D
WELL DEVELOPMENT RECORD

WELL DEVELOPMENT RECORD

WELL/PIEZOMETER ID ________
SHEET ______ of ______

PROJECT NAME: ________________ PROJECT NO. : __________________________ DATE: ____________________

LOCATION: ____________________ DATE INSTALLED: ____

TOTAL DEPTH (FTOC) ____________ CASING DIAMETER ____

METHODS OF DEVELOPMENT

☐ Swabbing ☐ Bailing ☐ Pumping ☐ Describe ______________________________

Equipment decomtaminated prior to development ☐ Yes ☐ NO

Describe____

EQUIPMENT NUMBERS:

pH Meter ______________ EC Meter ______________ Turbidity Meter ______________ Thermometer ______________

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION:

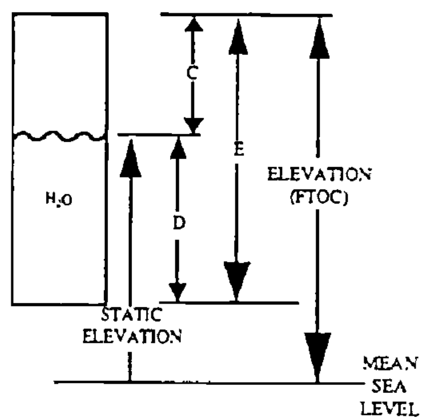
Measured Well Depth (B) ______________________ ft.

Measured Water Level Depth (C) __________________ ft.

Length of Static Water Column (D) ________ (B) - ________ (C) = __________ ft.

Casing Water Volume (E) + ________ (A) x ________ (D) = __________ gal

Total Purge Volume = __________ (gal)



Date	Time	Water Level (FTOC)	Volume Removed (gal)	pH	EC	Temperature F or C	Turbidity/ Sand (ppm)	Comments

AFCEE FORM WD.0

APPENDIX E
WASTE INVENTORY TRACKING FORM

WASTE INVENTORY TRACKING FORM

LOCATION : ______________________________

PROJECT NAME: ______________________________

ACTIVITIES: ______________________________

Date Waste Generated	Activity Generating Waste (borehole # / well #)	Description of Waste	Field Evidence of Contamination	Estimated Volume	Type of Container (storage ID#)	Location of Container	Waste Characterization	Comments

Note: Describe whether soil or water samples have been collected for waste characterization, include date, if known.

Signature: ______________________________

APPENDIX F
FIELD SAMPLING REPORT

FIELD SAMPLING REPORT

LOCATION: ____________________ PROJECT : ____________________

SITE: ____________________

SAMPLE INFORMATION

MATRIX ____________________ SAMPLE ID: ____________________

SAMPLING METHOD ____________________ DUP./REP. OF : ____________________

BEGINNING DEPTH ____________________ MATRIX SPIKE/MATRIX SPIKE DUPLICATE YES ( ) NO ( )

END DEPTH ____________________

GRAB ( ) COMPOSITE ( ) DATE: __________ TIME: __________

CONTAINER SIZE/TYPE	#	PRESERVATIVE/ PREPARATION	EXTRACTION METHOD	ANALYTICAL METHOD	ANALYSIS

NOTABLE OBSERVATIONS

PID READINGS	SAMPLE CHARACTERISTICS	MISCELLANEOUS
1st	COLOR:	
2nd	ODOR:	
	OTHER:	

GENERAL INFORMATION

WEATHER: SUN/CLEAR _____ OVERCAST/RAIN _____ WIND DIRECTION _______ AMBIENT TEMP _______

SHIPMENT VIA: FED-X _____ HAND DELIVER _____ COURIER _______ OTHER _______

SHIPPED TO: ____________________

COMMENTS: ____________________

SAMPLER: ____________________ OBSERVER: ____________________

MATRIX TYPE CODES

DC=DRILL CUTTINGS
WG=GROUND WATER
LH=HAZARDOUS LIQUID WASTE
SH=HAZARDOUS SOLID WASTE
SE=SEDIMENT
SL=SLUDGE
SO=SOIL
GS=SOIL GAS
WS=SURFACE WATER
SW=SWAP\WIPE

SAMPLING METHOD CODES

B=BAILER
BR=BRASS RING
CS=COMPOSITE SAMPLE
C=CONTINUOUS FLIGHT AUGER
DT=DRIVEN TUBE
W=SWAB\WIPE
G=GRAB
HA=HAND AUGER
H=HOLLOW STEM AUGER
HP=HYDRO PUNCH
SS=SPLIT SPOON
SP=SUBMERSIBLE PUMP

AFCEE FORM SR.0

APPENDIX G
MONITOR WELL PURGING FORM

MONITOR WELL PURGING FORM

PROJECT : ____________________ DATE: ____________

LOCATION: ____________________

EXPLOSIMETER BOREHOLE READING ________

WELL ID: ____________________

PURGE VOLUME
(3 WELLBORE VOLUMES): ____________ (gal)

WELL DEPTH: ____________________

Time	Depth to Water (ft)	Flow Meter Reading	Volume Purged (gal)	Temp. (°C)	pH	Electrical Conductivity (mmho)	Turbidity N.T.U	Comments

Note: Condition of the well: ______________________________

pH - Calibrate at start and before last reading.

Sampler ____________________ Observer ____________________

APPENDIX H
MONITOR WELL STATIC WATER LEVEL FORM

MONITOR WELL STATIC WATER LEVEL FORM

PROJECT NAME: ______________________________ DATE: ________________

WATER LEVEL INDICATOR ID # ____________ FIELD BOOK # ___________

LOCATION: ________________________________ PAGE # ________________

Monitor Well Number	Time	Depth to Static Water Level (from T.O.C.)	Total Well Depth (ft)	Explosimeter Reading (above background)	PID Reading (above background)

Note: Total well depth to be measured at time of gauging.

Comments: ____

____

____

Sampler ____________________________ Observer ____________________________

APPENDIX I
CHAIN-OF-CUSTODY FORM

The Environmental Company, Inc.

1230 Cedar Court • Suite 100
Post Office Box 5127
Charlottesville, Virginia 22905
(804)295-4446 • fax(804) 295-5535

CHAIN OF CUSTODY RECORD

PROJECT

SAMPLERS: (Signature)

SAMPLE NUMBER	DATE	TIME	MATRIX	NO. CONTAINERS	ANALYSIS REQUIRED										REMARKS OR SAMPLE LOCATION	PRESERVATION: ICED	PRESERVATION: SPECIFY CHEMICALS ADDED AND FINAL pH IF KNOWN

Relinquished by: (Signature) 1	Date / Time	Received by: (Signature)	Relinquished by: (Signature) 4	Date / Time	Shipped via:
Relinquished by: (Signature) 2	Date / Time	Received by: (Signature)	Received for Laboratory by: (Signature)	Date / Time	Shipping Ticket No.
Relinquished by: (Signature) 3	Date / Time	Received by: (Signature)	Remarks:		

N66246543

APPENDIX J

HEALTH AND SAFETY EXPOSURE MONITORINGING SHEET

AFCEE\M20002\FLD'LOG.WK3

CAR-J04-05K69904-M2-0012

HEALTH & SAFETY EXPOSURE MONITORING

PROJECT #: ____________________

PROJECT LOCATION : ____________________

PROJECT ACTIVITY: ____________________

DATE: ____________________

LOCATION MONITORED: ____________________

ACTIVITY MONITORED: ____________________

DRILL RIG TYPE/NO: ____________________

PERSONNEL AT THIS LOCATION: ____________________

PERSONNEL AFFECTED BY H&S MONITORING: ____________________

TIME (24 hr clock)	BACK-GROUND	MONITOR INTERVAL (boreholes depth)	FID (ppm)	PID (ppm)	%O2 (%)	% LEL (%)	H2S (ppm)	RAM (ppm)	OTHER	SAMPLES INITIALS

INSTRUMENT	MFGR/ MODEL #	INSTRUMENT SERIAL #	CALIBRATION STANDARD			END OF DAY CALIBRATION CHECK	END OF DAY CALIBRATION CHECK
			CAL GAS	STD (ppm)	LOT #		
FID							
PID							
%O2							
%LEL							
H2S							
RAM							

FIELD TEAM LEADER SIGNATURE ____________________

APPENDIX K
INSTRUMENT CALIBRATION LOG

EQUIPMENT CALIBRATION LOG SHEET

EQUIPMENT NUMBER: ____________ Page ____ of ____

EQUIPMENT DESCRIPTION: ____________

DATE	TIME	MANUFACTURER OF STANDARD	LIQUID/GAS NAME	STANDARD CONCENTRATION	STANDARD LOT NO.	EXPIRATION DATE	INITIAL READING	CORRECTED READING	OPERATORO SIGNATURE	COMMENTS

APPENDIX L

INSTRUMENT MAINTENANCE RECORD

INSTRUMENT MAINTENANCE RECORD

EQUIPMENT NAME: ______________________________ Page ____ of __________

EQUIPMENT NUMBER: ______________

EQUIPMENT VENDOR: ______________

DATE	PROJECT NUMBER	MAINTENANCE DESCRIPTION	OPERATOR SIGNATURE	DATE COMPLETED

APPENDIX M
EQUIPMENT DECONTAMINATION LOG SHEET

EQUIPMENT DECONTAMINATION LOG SHEET

EQUIPMENT NUMBER: ________________ Page ____ of ___________

EQUIPMENT DESCRIPTION: ____________________________________

DATE	TIME	DETERGENT WASH	TAP WATER RINSE	SOLVENT RINSE (TYPE)	WATER RINSE (TYPE)	AIR DRY	TYPE OF WRAPPING	RINSATE SAMPLE ID	OPERATOR SIGNATURE	COMMENTS
ITEM		MANUFACTURER		LOT NUMBERS	EXP. DATE					
DETERGENT:										
SOLVENT										
WATER										

TAB

Quality Assurance Project Plan

QUALITY ASSURANCE PROJECT PLAN

SITE ASSESSMENT, INVESTIGATION, AND CHARACTERIZATION OF THE RECREATIONAL VEHICLE (RV) FAMILY CAMPING (FAM CAMP) AREA

NAVAL AIR STATION (NAS) FORT WORTH JOINT RESERVE BASE (JRB) CARSWELL FIELD, TEXAS

Contract No. F41624-95-D-8002
Delivery Order 0003

July 1996

Prepared for:

Air Force Material Command (AFMC)
Headquarters (HQ) Human Systems Center (HSC) PKVCC
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Brooks AFB, Texas 78235-5353

Prepared by:

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Charlottesville, Virginia 22905

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A. Scott Neese, Ph.D Corporate Quality Assurance Manager	1	12

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PREFACE

A site assessment/investigation (SA/SI) and a site characterization (SC) of the area in the vicinity of the Recreational Vehicle (RV) Family Camping (Fam Camp) Area at Naval Air Station (NAS) Fort Worth, Joint Reserve Base, Carswell Field, Texas (identified as Project No. 95-8021) will be conducted to determine the presence or absence of contamination and to define the nature and extent of such contamination if present.

This Quality Assurance Project Plan (QAPP) was prepared by The Environmental Company, Inc. (TEC) under contract No. F41624-95-D-8002, Delivery Order 0003. This QAPP is a project scoping document for Project No. 95-8021. This QAPP was written for use by TEC and any others who are authorized by the Project Manager to conduct sampling and/or analysis for NAS Fort Worth JRB in accordance with the contract. This QAPP is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if these operations or conditions change.

This QAPP was written under the direction of Mr. Glenn Metzler, TEC Project Manager. The Contracting Officer's Representative for this project is Mr. Charles Rice, Air Force Center for Environmental Excellence (AFCEE), Environmental Restoration Branch (ERB), Brooks Air Force Base (AFB), Texas.

Approval By: Date:

Glenn M. Metzler — July 9, 96

Glenn M. Metzler
Project Manager
The Environmental Company, Inc.

Approval By: Date:

Jack E. Wilson — July 9, 1996

Jack E. Wilson, P.E.
Project Director
The Environmental Company, Inc.

Approval By: Date:

A. Scott Neese — July 9, 1996

A. Scott Neese, Phd.
Quality Assurance Manager
The Environmental Company, Inc.

NOTICE

This report has been prepared for the United States Air Force by The Environmental Company, Inc. (TEC) for the purpose of aiding in the implementation of a final remedial action plan under the Air Force Installation Restoration Program (IRP).

Although the area of study is being investigated in accordance with IRP guidance, the area has not been identified as an IRP site. NAS Fort Worth (formerly Carswell Air Force Base) is undergoing property disposal/reuse pursuant to the Defense Base Closure and Realignment Act of 1990 and Round II of the Base Closure Commission deliberations. The area of study is being considered for property disposal or reuse and the Air Force Base Conversion Agency (AFBCA) desires to investigate the area to confirm or deny the presence of contamination.

As the report relates to actual or possible releases of potentially hazardous substances, its release prior to a United States Air Force final decision on remedial action may be in the public's interest. The limited objectives of this report and the ongoing nature of the IRP, along with the evolving knowledge of site conditions and chemical effects on the environment and health, must be considered when evaluating this report since subsequent facts may become known that may make this report premature or inaccurate.

Acceptance of this report in performance of the contract under which it is prepared does not mean that the Air Force adopts the conclusions, recommendations, or other views expressed herein, which are those of the contractor only and do not necessarily reflect the official position of the United States Air Force.

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379 ... 400

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*

2. REPORT DATE
July 1996

3. REPORT TYPE AND DATES COVERED
Final-July 1996

4. TITLE AND SUBTITLE
QUALITY ASSURANCE PROJECT PLAN
SITE ASSESSMENT, INVESTIGATION, AND CHARACTERIZATION OF THE RECREATIONAL VEHICLE (RV) FAMILY CAMPING (FAM CAMP) AREA
NAVAL AIR STATION (NAS) FORT WORTH
JOINT RESERVE BASE (JRB)
CARSWELL FIELD, TEXAS

5. FUNDING NUMBERS
F41624-95-D-8002
Delivery Order 0003

6. AUTHOR(S)
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NA

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Air Force Center for Environmental Excellence
Base Closure Division
Brooks AFB, TX 78235

10. SPONSORING/MONITORING AGENCY REPORT NUMBER
NA

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

This Quality Assurance Project Plan presents, in specific terms the policies, organization, functions, and Quality Assurance/Quality Control (QA/QC) requirements designed to achieve data quality goals described in the approved Sampling and Analysis Plan (SAP) for the project. This project-specific QAPP has been prepared to ensure that the data are scientifically valid and defensible, and establishes the analytical protocols and documentation requirements to ensure that the data are collected, reviewed, and analyzed in a consistent manner. This site-specific QAPP and the Air Force Center for Environmental Excellence (AFCEE) Field Sampling Plan (FSP) shall constitute, by definition, an AFCEE Sampling and Analysis Plan (SAP).

14. SUBJECT TERMS
QUALITY ASSURANCE PROJECT PLAN

15. NUMBER OF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	

NSN 7540-01-280-5500

Standard Form 298 (Rev 2-89)
Prescribed by ANSI Std 239-18
298-102

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LIST OF ACRONYMS AND ABBREVIATIONS

AA	atomic absorption
AFCEE	Air Force Center for Environmental Excellence
AFIID	Air Force installation identification
A2LA	American Association for Laboratory Accreditation
ARAR	applicable or relevant and appropriate requirement
ASCII	American Standard Code Information Interchange
ASTM	American Society for Testing and Materials
BFB	bromofluorobenzene
Br^-	bromide
BTEX	benzene, toluene, ethylbenzene, xylene
°C	degrees Celsius
CCC	calibration check compound
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CF	calibration factor
CFR	Code of Federal Regulation
Cl^-	chloride
CL	control limit
CLP	Contract Laboratory Program
COC	chain of custody
2,4-D	2,4-dichlorophenoxy acetic acid
2,4-DB	2,4-dichlorophenoxy butyric acid
DCA	dichloroethane
DCB	dichlorobenzene
DCBP	decachlorobiphenyl
DCE	dichloroethene
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DFTPP	decafluorotriphenylphosphine
DNB	dinitrobenzene

DNT	dinitrotoluene
DOD	Department of Defense
DQO	data quality objective
DRO	diesel range organics
EDB	ethylene dibromide
EICP	extracted ion current profile
EPA	Environmental Protection Agency
F^-	fluoride
FID	flame ionization detector
FLAA	flame atomic absorption
FS	feasibility study
FSP	field sampling plan
g	gram
G	glass
GC	gas chromatography
GC/MS	gas chromatography/mass spectroscopy
GFAA	graphite furnace atomic absorption
GRO	gasoline range organics
Handbook	*Handbook for the Installation Restoration Program (IRP) Remedial Investigation and Feasibility Studies (RI/FS)*, September 1993
HCl	hydrochloric acid
HECD	(Hall) electrolytic conductivity detector
HpCDD	heptachlorodibenzo-p-dioxin
HpCDF	heptaclorordibenzofuran
HxCDD	hexachlorodibenzo-p-dioxin
HxCDF	hexachlorodibenzofuran
HMX	octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
HNO_3	nitric acid
HPLC	high-performance liquid chromatography
H_2SO_4	sulfuric acid
IAW	in accordance with
ICP	inductively coupled plasma
ICPES	inductively coupled plasma emission spectroscopy

ICP-MS	inductively coupled plasma - mass spectroscopy
ICS	interference check standard
ID	identification
IRP	Installation Restoration Program
IRPIMS	Installation Restoration Program Information Management System
IS	internal standard
LCL	lower control limit
LCS	laboratory control sample
MCPA	(4-chloro-2-methylphenoxy) acetic acid
MCPP	2-(4-chloro-2-methylphenoxy) propionic acid
MDL	method detection limit
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mL	milliliter
mm	millimeter
MS	matrix spike
MSD	matrix spike duplicate
MTBE	methyl tert butyl ether
N/A	not applicable
$Na_2S_2O_3$	sodium thiosulfate
NCP	National Contingency Plan
ng/L	nanograms per liter
ng/mL	nanograms per milliliter
NIST	National Institute of Standards and Technology
nm	nanometer
NO_2^-	nitrite
NO_3^-	nitrate
NTU	nephelometric turbidity unit
OCDD	octachlorodibenzo-p-dioxin
ORP	oxidation-reduction potential
OVA	organic vapor analyzer
P	polyethylene
PAH	polynuclear aromatic hydrocarbon

PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzo-p-dioxin
PCDF	polychlorinated dibenzofuran
PE	performance evaluation
PeCDD	pentachlorodibenzo-p-dioxin
PeCDF	pentachlorodibenzofuran
PID	photoionization detector
PO_4^{-3}	phosphate
ppb	parts per billion
ppm	parts per million
ppmv	parts per million volume
PQL	practical quantitation limit
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
R	recovery
RCA	recommendations for corrective action
RCRA	Resource Conservation and Recovery Act
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RF	response factor
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
RPD	relative percent difference
RSD	relative standard deviation
S	soil
SAP	sampling and analysis plan
SARA	Superfund Amendments and Reauthorization Act
SO_4^{-2}	sulfate
SOP	standard operating procedure
SOW	statement of work
SPCC	system performance check compound
SVOC	semivolatile organic compound
2,4,5-T	2,4,5-trichlorophenoxy acetic acid

T	California brass
TCA	trichloroethane
TCDD	tetrachlorodibenzo-p-dioxin
TCDF	tetrachlorodibenzofuran
TCE	trichloroethene
TCLP	toxicity characteristic leaching procedure
TCMX	tetrachlorometaxylene
TIC	tentatively identified compound
TNB	trinitrobenzene
TNT	trinitrotoluene
2,4,5-TP	2,4,5-trichlorophenoxy acetic acid (silvex)
TPH	total petroleum hydrocarbon
UCL	upper control limit
VOC	volatile organic compound
v/v	volume to volume
W	water

SYMBOLS

mg/kg	micrograms per kilogram
mg/L	micrograms per liter
mg/mL	micrograms per milliliter
mL	microliter
mm	micrometer

1.0 INTRODUCTION

The Quality Assurance Project Plan (QAPP) presents in specific terms the policies, organization, functions, and Quality Assurance/Quality Control (QA/QC) requirements designed to achieve the data quality goals described in the approved Sampling and Analysis Plan (SAP) for the project. This detailed QAPP has been prepared to ensure the data are scientifically valid and defensible, and establishes the analytical protocols and documentation requirements to ensure that the data are collected, reviewed, and analyzed in a consistent manner. This QAPP and a site-specific Field Sampling Plan (FSP) shall constitute, by definition, an AFCEE Sampling and Analysis Plan (SAP).

The National Contingency Plan (NCP) specifies circumstances under which a QAPP is necessary for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response actions. For cleanup actions at the remedial investigation/feasibility study (RI/FS) stage, the NCP requires lead agents to develop sampling and analysis plans which provide a process for obtaining data of sufficient quality and quantity to satisfy data needs. Such sampling and analysis plans must include a quality assurance project plan "which describes policy, organization, and functional activities and the data quality objectives and measures necessary to achieve adequate data for use in selecting the appropriate remedy" 40 CFR 300.430 (b)(8)(ii).

The U.S. Environmental Protection Agency (EPA) QA policy requires a QAPP for every monitoring and measurement project mandated or supported by the EPA through regulations, contracts, or other formalized means not currently covered by regulation. Guidelines followed in the preparation of this plan are set out in *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans* (U.S. EPA, 1983a) and *U.S. EPA Region IX QAPP: Guidance for Preparing QAPPs for Superfund Remedial Projects* (U.S. EPA, 1989). Other documents that have been referenced for this plan include *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final* (U.S. EPA, 1988); *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, Draft Final, EPA QA/R-5* (U.S. EPA, 1993), *Compendium of Superfund Field Operations Methods* (U.S. EPA, 1987a); *Data Quality Objectives Process for Superfund, Interim Final Guidance* (U.S. EPA, 1993); *U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (U.S. EPA, 1994), *U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (U.S. EPA, 1994), *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (U.S. EPA SW-846, Third Edition and its first and second update), and the *Handbook for Installation Restoration Program (IRP) Remedial Investigations and Feasibility Studies (RI/FS)* (Handbook), September 1993.

This QAPP is required reading for all staff participating in the work effort. The QAPP shall be in the possession of the field teams and in the laboratories performing all analytical methods. All contractors and subcontractors shall be required to comply with the procedures documented in this QAPP in order to maintain comparability and representativeness of the data produced.

Controlled distribution of the QAPP shall be implemented by the prime contractor to ensure that the current version is being used. A sequential numbering system shall be used to identify controlled copies of the QAPP. Controlled copies shall be provided to applicable Air Force managers, regulatory agencies, remedial project managers, project managers, and QA coordinators. Whenever Air Force revisions are made or addenda added to the QAPP, a document control system shall be put into place to ensure (1) all parties holding a controlled copy of the QAPP shall receive the revisions/addenda and (2) outdated material is removed from circulation. The document control system does not preclude making and using copies of the QAPP; however, the holders of controlled copies are responsible for distributing additional material to update any copies within their organizations. The distribution list for controlled copies shall be maintained by the prime contractor.

2.0 PROJECT DESCRIPTION

2.1 THE U.S. AIR FORCE INSTALLATION RESTORATION PROGRAM

The objective of the U.S. Air Force Installation Restoration Project (IRP) is to assess past hazardous waste disposal and spill sites at U.S. Air Force installations and to develop remedial actions consistent with the NCP for sites that pose a threat to human health and welfare or the environment. This section presents information on the program origins, objectives, and organization.

The 1976 Resource Conservation Recovery Act (RCRA) is one of the primary Federal laws governing the disposal of hazardous wastes. Sections 6001 and 6003 of RCRA require Federal agencies to comply with local and state environmental regulations and provide information to the EPA concerning past disposal practices at Federal sites. RCRA Section 3012 requires state agencies to inventory past hazardous waste disposal sites and provide information to the EPA concerning those sites.

In 1980, Congress enacted CERCLA (Superfund). CERCLA outlines the responsibility for identifying and remediating contaminated sites in the United States and its possessions. The CERCLA legislation identifies the EPA as the primary policy and enforcement agency regarding contaminated sites.

The 1986 Superfund Amendments and Reauthorization Act (SARA) extends the requirements of CERCLA and modifies CERCLA with respect to goals for remediation and the steps that lead to the selection of a remedial process. Under SARA, technologies that provide permanent removal or destruction of a contaminant are preferable to action that only contains or isolates the contaminant. SARA also provides for greater interaction with public and state agencies and extends the EPA's role in evaluating health risks associated with contamination. Under SARA, early determination of Applicable or Relevant and Appropriate Requirements (ARARs) is required, and the consideration of potential remediation alternatives is recommended at the initiation of an RI/FS. SARA is the primary legislation governing remedial action at past hazardous waste disposal sites.

Executive Order 12580, adopted in 1987, gave various Federal agencies, including the Department of Defense (DOD), the responsibility to act as lead agencies for conducting investigations and implementing remediation efforts when they are the sole or co-contributor to contamination on or off their properties.

To ensure compliance with CERCLA, its regulations, and Executive Order 12580, the DOD developed the IRP, under the Defense Environmental Restoration Program, to identify potentially contaminated sites, investigate these sites, and evaluate and select remedial actions for potentially contaminated facilities. The DOD issued the Defense Environmental Quality Program Policy Memorandum (DEQPPM) 80-6 regarding the IRP program in June 1980, and implemented the policies outlined in this memorandum in December 1980. The NCP was issued by the EPA in 1980 to provide guidance on a process by which (1) contaminant release could be reported, (2) contamination could be identified and quantified, and (3) remedial actions could be selected. The NCP describes the responsibility of Federal and state governments and those responsible for contaminant releases.

The DOD formally revised and expanded the existing IRP directives and amplified all previous directives and memoranda concerning the IRP through DEQPPM 81-5, dated 11 December 1981. The memorandum was implemented by a U.S. Air Force message dated 21 January 1982.

The IRP is the DOD's primary mechanism for response actions on U.S. Air Force installations affected by the provisions of SARA. In November 1986, in response to SARA and other EPA interim guidance, the U.S. Air Force modified the IRP to provide for an RI/FS program. The IRP was modified so that RI/FS studies could be conducted as parallel activities rather than serial activities. The program now includes ARAR determinations, identification and screening of technologies, and development of alternatives. The IRP may include multiple field activities and pilot studies prior to a detailed final analysis of alternatives. Over the years, requirements of the IRP have been developed and modified to ensure that DOD compliance with Federal laws, such as RCRA, NCP, CERCLA, and SARA, can be met.

2.2 PURPOSE AND SCOPE

This QAPP has been developed for a site assessment/investigation and site characterization at the Recreational Vehicle - Family Camping Area and adjacent underground pipeline at NAS Fort Worth. Refer to the Work Plan for a discussion of the purpose, scope, and use of this work effort.

2.3 PROJECT BACKGROUND

For a project background description, including the locations of sites at the base or facility, a summary of the contamination history at each site, and the findings from previous investigations, refer to the Work Plan and Sections 2.3 and 2.4 of the Field Sampling Plan (FSP).

2.4 PROJECT SCOPE AND OBJECTIVES

A summary of the objectives and the proposed work for each site is included in Section 3.0 of the FSP. The intended use of the data acquired during this project, the data quality objective process and a discussion of how the process-specific decision rules were derived is also described in Section 3.1 of the FSP.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The project organization and responsibility discussion is included in the Work Plan and Section 4.0 of the FSP. It includes the following elements:

- A project organizational chart identifying task managers and individuals responsible for performance of the project;
- A list of names of all key participants, including organization names and telephone numbers for project, field, and laboratory QA officers;
- A description of the authority given to each key participant with an emphasis on the authority of the key individuals to initiate and approve corrective actions; and
- The role of regulatory representatives.

Subcontractors to be utilized and the scope of their performance in the project are defined in Section 4.1 of the FSP. The analytical laboratory that will be used for this project is Inchcape Testing Services of Richardson, Texas. AFCEE performed an audit of this laboratory during the period of 28 February to 1 March 1996. The laboratory was described in the AFCEE Evaluation as "very capable of performing work to AFCEE's standards".

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4.0 QUALITY PROGRAM AND DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) specify the data type, quality, quantity, and uses needed to make decisions and are the basis for designing data collection activities. The DQOs for the project are summarized in Table 4.1-1.

4.1 DATA CATEGORIES

The two general categories of data used by the Air Force Center for Environmental Excellence (AFCEE) are defined as screening data and definitive data.

Screening data are generated by rapid methods of analysis with less rigorous sample preparation, calibration, and/or QC requirements than are necessary to produce definitive data. Sample preparation steps may be restricted to simple procedures such as dilution with a solvent, instead of elaborate extraction/digestion and cleanup. Screening data may provide analyte identification and quantitation, although the quantitation may be relatively imprecise.

Table 4.1-1 Data Quality Objectives.

Data Type	Data Category or System	Type of Samples	Qty. of Samples[a]	Use of Data
Geophysical	Screening	None	NA	Locate abandoned leachfield, underground utilities.
Land Survey	State Plane Coordinates	None	NA	Accurately locate easements, soil borings, monitoring wells.
Soil Gas Screening	Screening	Passive Soil Gas Collectors	70	Identify areas of potential VOC and SVOC contamination in the subsurface.
Soil Characteristics	Screening	Grain Size Analysis	5	To aid in the understanding of site-specific geology and contaminant migration.
Soil and Groundwater Contamination	Definitive	Soil and Groundwater	Soil-40 GW-6	Quantify the magnitude and extent of contamination; risk assessment.
Groundwater Characteristics	Physical Measurement	Depth to Groundwater	6	Determine depth to groundwater and direction of groundwater flow.
Waste Characteristics	Definitive	Soil and water	Soil-3 GW-2	Characterize to allow proper disposal of waste.

[a] Exclusive of QC samples.
NA Not Applicable.

Physical test methods (e.g., dissolved oxygen measurements, temperature and pH measurements, moisture content, turbidity, conductance, etc.) have been designated by definition as screening methods (see Section 6.0 of this document).

Screening methods shall be confirmed where possible, as required in Section 3.2 of the FSP, by analyses that generate definitive data. Confirmation samples shall be selected to include both detected and nondetected results from the screening method.

Definitive data are generated using rigorous analytical methods (see Section 7.0), such as approved EPA reference methods. The data can be generated in a mobile or off-site laboratory. Data are analyte-specific, and both identification and quantitation are confirmed. These methods have standardized QC and documentation requirements (Sections 7.0 and 8.0). Definitive data are not restricted in their use unless quality problems require data qualification.

4.2 PRECISION, ACCURACY, REPRESENTATIVENESS, COMPLETENESS, AND COMPARABILITY

The basis for assessing each of these elements of data quality is discussed in the following subsections. Precision and accuracy QC limits for each method and matrix are identified in Sections 6.0 and 7.0.

4.2.1 Precision

Precision measures the reproducibility of measurements. It is strictly defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar conditions. Analytical precision is the measurement of the variability associated with duplicate (two) or replicate (more than two) analyses. AFCEE uses the laboratory control sample (LCS) to determine the precision of the analytical method. If the recoveries of analytes in the LCS are within established control limits, then precision is within limits. In this case, the comparison is not between a sample and a duplicate sample analyzed in the same batch, rather the comparison is between the sample and samples analyzed in previous batches.

Total precision is the measurement of the variability associated with the entire sampling and analysis process. It is determined by analysis of duplicate or replicate field samples and measures variability introduced by both the laboratory and field operations. Field duplicate samples and matrix duplicate spiked samples shall be analyzed to assess field and analytical precision, and the precision measurement is determined using the relative percent difference (RPD) between the duplicate sample results. The formula for the calculation of precision is provided in Table 4.2.1-1 as RPD. For replicate analyses, the relative standard deviation (RSD) is determined. The formula for the calculation of RSD is provided in Table 4.2.1-1.

4.2.2 Accuracy

Accuracy is a statistical measurement of correctness and includes components of random error (variability due to imprecision) and systemic error. It therefore reflects the total error associated with a measurement. A measurement is accurate when the value reported does not differ from the true value or known concentration of the spike or standard. Analytical accuracy is measured by comparing the percent recovery of analytes spiked into an LCS to a control limit. For volatile and semivolatile organic compounds, surrogate compound recoveries are also used to assess accuracy and method performance for each sample analyzed. Analysis of performance evaluation (PE) samples shall also be used to provide additional information for assessing the accuracy of the analytical data being produced.

Both accuracy and precision are calculated for each AFCEE analytical batch, and the associated sample results are interpreted by considering these specific measurements. The formula for calculation of accuracy is included in Table 4.2.1-1 as percent recovery (%R) from pure and sample matrices.

Table 4.2.1-1 Statistical Calculations

Statistic	Symbol	Formula	Definition	Uses
Mean	$\overline{X}$	$\dfrac{\left(\sum_{i=1}^{n} x_i\right)}{n}$	Measure of central tendency	Used to determine average value of measurements
Standard Deviation	S	$\left(\dfrac{\Sigma(x_i-\overline{x})^2}{(n-1)}\right)^{>}$	Measure of relative scatter of the data	Used in calculating variation of measurements
Relative Standard Deviation	RSD	$(S/\overline{X}) \times 100$	Relative standard deviation, adjusts for magnitude of observations	Used to assess precision for replicate results
Percent Difference	%D	$\dfrac{x_1 - x_2}{x_1} \times 100$	Measure of the difference of 2 observations	Used to assess accuracy
Relative Percent Difference	RPD	$\left(\dfrac{(X_1 - X_2)}{(X_1 + X_2)/2}\right) \times 100$	Measure of variability that adjusts for the magnitude of observations	Used to assess total and analytical precision of duplicate measurements
Percent Recovery	%R	$\left(\dfrac{X_{meas}}{X_{true}}\right) \times 100$	Recovery of spiked compound in pure matrix	Used to assess accuracy
Percent Recovery	%R	$\dfrac{\left(\text{value of spiked sample} - \text{value of unspiked sample}\right)}{\text{Value of added spike}} \times 100$	Recovery of spiked compound in sample matrix	Used to assess matrix effects and total precision

x = Observation (concentration)
n = Number of observations

4.2.3 Representativeness

Objectives for representativeness are defined for each sampling and analysis task and are a function of the investigative objectives. Representativeness shall be achieved through use of the standard field, sampling, and analytical procedures. Representativeness is also determined by appropriate program design, with consideration of elements such as proper well locations, drilling and installation procedures, and sampling locations. Decisions regarding sample/well/ boring locations and numbers and the statistical sampling design are documented in Section 3.3 of the FSP.

4.2.4 Completeness

Completeness is calculated for the aggregation of data for each analyte measured for any particular sampling event or other defined set of samples. Completeness is calculated and reported for each method, matrix, and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. For completeness requirements, valid results are all results not qualified with an "R" flag (see Section 8.0 for an explanation of flagging criteria). The requirement for completeness is 95 percent for aqueous samples and 90 percent for soil samples. For any instances of samples that could not be analyzed for any reason (holding time violations in which resampling and analysis were not possible, samples spilled or broken, or other reason), the numerator of this calculation becomes the number of valid results minus the number of possible results not reported.

The formula for calculation of completeness is presented below:

$$\%\ \text{completeness} = \frac{\text{number of valid (i.e., non-R flagged) results}}{\text{number of possible results}}$$

4.2.5 Comparability

Comparability is the confidence with which one data set can be compared to another data set. The objective for this QA/QC program is to produce data with the greatest possible degree of comparability. The number of matrices that are sampled and the range of field conditions encountered are considered in determining comparability. Comparability is achieved by using standard methods for sampling and analysis, reporting data in standard units, normalizing results to standard conditions, and using standard and comprehensive reporting formats. Complete field documentation using standardized data collection forms shall support the assessment of comparability. Analysis of performance evaluation (PE) samples and reports from audits shall also be used to provide additional information for assessing the comparability of analytical data produced among subcontracting laboratories. Historical comparability shall be achieved through consistent use of methods and documentation procedures throughout the project.

4.3 METHOD DETECTION LIMITS, PRACTICAL QUANTITATION LIMITS, AND INSTRUMENT CALIBRATION REQUIREMENTS

4.3.1 Method Detection Limits

The method detection limit (MDL) is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. The laboratory shall establish MDLs for each method, matrix, and analyte for each instrument the laboratory plans to use for the project. The laboratory shall revalidate these MDLs on an annual basis. The laboratory shall provide the MDL demonstrations to AFCEE at the beginning of the project (i.e., before project samples are analyzed) and upon request in the format specified in Section 8.0. Results less than the MDL shall be reported as the PQL value and flagged with an "F" (see Section 8.0).

Laboratories participating in this work effort shall demonstrate the MDLs for each instrument, including confirmatory columns, method of analysis, analyte, and matrix (i.e., water and soil) using the following instructions:

1. Obtain the concentration value that corresponds to:
    a) an instrument signal/noise ratio within the range of 2.5 to 5.0, or
    b) the region of the standard curve where there is a significant change in sensitivity (i.e., a break in the slope of the standard curve).
2. Analyze seven replicates of a matrix spike (ASTM Type II water for aqueous methods, Ottawa sand for soil methods) containing the analyte of interest at a concentration three to five times the estimated MDL.
3. Determine the variance (S^2) for each analyte as follows:

$$S^2 = \frac{1}{n-1}\left[\sum_{i=1}^{n}\left(x_i - \overline{x}\right)^2\right]$$

where x_i = the ith measurement of the variable x and $\overline{x}$ = the average value of x

$$\overline{X} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

4. Determine the standard deviation(s) for each analyte as follows:

$$s = (S^2)^{1/2}$$

5. Determine the MDL for each analyte as follows:

$$MDL = 3.14(s)$$

(note: 3.14 is the one-sided t-statistic at the 99 percent confidence level appropriate for determining the MDL using 7 samples)

4.3.2 Practical Quantitation Limits

The practical quantitation limit (PQL) is the lowest level that can be reasonably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. The laboratories participating in this work effort shall compare the results of the MDL demonstrations to the PQLs for each method listed in Section 7.0. All MDLs shall be lower than the relevant PQLs. The laboratories shall also verify PQLs by including a standard at or below the PQL as the lowest point on the calibration curve. All results shall be reported at or above the MDL values, however, for those results falling between the MDL and the PQL, a "J" flag shall be applied to the results indicating the variability associated with the result (see Section 8.0).

4.3.3 Instrument Calibration

Analytical instruments shall be calibrated in accordance with the analytical methods. All analytes reported shall be present in the initial and continuing calibrations, and these calibrations must meet the acceptance criteria specified in Section 7.0. Records of standard preparation and instrument calibration shall be maintained. Records shall unambiguously trace the preparation of standards and their use in calibration and quantitation of sample results. Calibration standards shall be traceable to standard materials.

Instrument calibration shall be checked using all of the analytes listed for a given method in the QC acceptance criteria table in Section 7.0. This applies equally to multi-response analytes. All calibration criteria shall satisfy SW-846 requirements at a minimum. The initial calibration shall be checked at the frequency specified in the method using materials prepared independently of the calibration standards. Acceptance criteria for the calibration check are presented in Section 7.0. Analyte concentrations are determined with either calibration curves or response factors (RFs). For gas chromatography (GC) and gas chromatography/mass spectroscopy (GC/MS) methods, when using RFs to determine analyte concentrations, the average RF from the initial five point calibration shall be used. The continuing calibration shall not be used to update the RFs from the initial five point calibration.

4.4 ELEMENTS OF QUALITY CONTROL

QC elements relevant to screening data are presented in Section 6.0. This section presents QC requirements relevant to analysis of environmental samples that shall be followed during all analytical activities for fixed-base, mobile, and field laboratories producing definitive data. The purpose of this QC program is to produce data of known quality that satisfy the project objectives and that meet or exceed the requirements of the standard methods of analysis. This program provides a mechanism for ongoing control and evaluation of data quality measurements through the use of QC materials.

Laboratory QC samples (e.g., blanks and laboratory control samples) shall be included in the preparation batch with the field samples. An AFCEE analytical batch is a number of samples (not to exceed 20 environmental samples plus the associated laboratory QC samples) that are similar in composition (matrix) and that are extracted or digested at the same time and with the same lot of reagents. Matrix spikes and matrix spike duplicates do not count as environmental samples. The term AFCEE analytical batch also extends to cover samples that do not need separate extraction or digestion (e.g., volatile analyses by purge and trap). This AFCEE analytical batch is a number of samples (not to exceed 20 environmental samples plus the associated laboratory QC samples) that are similar in composition (matrix) analyzed sequentially within a calibration period. The identity of each AFCEE analytical batch shall be unambiguously reported with the analyses so that a reviewer can identify the QC samples and the associated environmental samples. All references to the analytical batch in the following sections and tables in this QAPP refer to the AFCEE analytical batch.

The type of QC samples and the frequency of use of these samples are discussed below and in the method-specific subsections of Section 7.0.

4.4.1 Laboratory Control Sample

The laboratory control sample (LCS) is analyte-free water for aqueous analyses or Ottawa sand (or equivalent) for soil analyses spiked with known concentrations of all analytes listed in the QC acceptance criteria table in Section 7.0 for the method. The LCS shall be carried through the complete sample preparation and analysis procedure.

The LCS is used to evaluate each AFCEE analytical batch and to determine if the method is in control. One LCS shall be included in every AFCEE analytical batch. The performance of the LCS is evaluated against the QC acceptance limits given in the tables in Section 7.0.

Whenever an analyte in an LCS is outside the acceptance limit, corrective action shall be performed. After the system problems have been resolved and system control has been re-established, all samples in the AFCEE analytical batch shall be reanalyzed for the out-of-control analyte(s). When an analyte in an LCS exceeds the upper or lower control limit and no corrective action is performed, or the corrective action was ineffective, the appropriate validation flag, as described in Sections 7.0 and 8.0, shall be applied to all affected results.

4.4.2 Matrix Spike/Matrix Spike Duplicate

A matrix spike (MS) and matrix spike duplicate (MSD) are aliquots of the sample spiked with a known concentration of all analytes listed in the QC acceptance criteria table in Section 7.0 for the method. The spiking occurs prior to sample preparation and analysis. Only AFCEE samples shall be used for spiking. The MS/MSD shall be designated on the chain-of-custody.

The MS/MSD is used to document the bias of a method due to sample matrix. AFCEE does not use MSs and MSDs to control the analytical process.

A minimum of one MS and one MSD sample shall be analyzed for every 20 AFCEE samples.

The performance of the MS and MSD is evaluated against the QC acceptance limits given in the tables in Section 7.0. If either the MS or the MSD is outside the QC acceptance limits, the analytes in all related samples shall be qualified according to the data flagging criteria in Sections 7.0 and 8.0.

4.4.3 Surrogates

Surrogates are organic compounds that are similar to the target analyte(s) in chemical composition and behavior in the analytical process, but that are not normally found in environmental samples.

Surrogates are used to evaluate accuracy, method performance, and extraction efficiency. Surrogates shall be added to environmental samples, controls, and blanks in accordance with the method requirements.

Whenever a surrogate recovery is outside the acceptance limit, corrective action must be performed. After the system problems have been resolved and system control has been re-established, the sample should be reprepared and reanalyzed. If corrective actions are not performed or are ineffective, the appropriate validation flag, as described in Sections 7.0 and 8.0, shall be applied to the sample results.

4.4.4 Internal Standards

Internal standards (ISs) are measured amounts of certain compounds added after preparation or extraction of a sample. They are used in an IS calibration method to correct sample results affected by column injection losses, purging losses, or viscosity effects. ISs shall be added to environmental samples, controls, and blanks in accordance with the method requirements.

When the IS results are outside of the acceptance limits, corrective actions shall be performed. After the system problems have been resolved and system control has been re-established, all samples analyzed while the system was malfunctioning shall be reanalyzed. If corrective actions are not performed or are ineffective, the appropriate validation flag, as described in Sections 7.0 and 8.0, shall be applied to the sample results.

4.4.5 Retention Time Windows

Retention time windows are used in GC and high performance liquid chromatography (HPLC) analysis for qualitative identification of analytes. They are calculated from replicate analyses of a standard on multiple days. The procedure and calculation method are given in SW-846 Method 8000A.

When the retention time is outside of the acceptance limits, corrective action shall be performed. After the system problems have been resolved and system control has been re-established, all the samples analyzed since the last acceptable retention time check should be reanalyzed. If corrective actions are not performed, the appropriate validation flag, as described in Sections 7.0 and 8.0, shall be applied to the sample results.

4.4.6 Interference Check Sample

The interference check sample (ICS), used in inductively coupled plasma (ICP) analyses only, contains both interfering and analyte elements of known concentrations The ICS is used to verify background and inter-element correction factors. The ICS is run at the beginning and end of each run sequence.

When the interference check sample results are outside of the acceptance limits stated in the method, corrective action shall be performed. After the system problems have been resolved and system control has been re-established, the ICS should be reanalyzed. If the ICS result is acceptable, reanalyze all affected samples. If corrective action is not performed or the corrective action was ineffective, the appropriate validation flag, as described in Sections 7.0 and 8.0, shall be applied to all affected results.

4.4.7 Method Blank

A method blank is an analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank shall be carried through the complete sample preparation and analytical procedure. The method blank is used to document contamination resulting from the analytical process. A method blank shall be included in every AFCEE analytical batch.

The presence of analytes in a method blank at concentrations greater than the PQL indicates a need for corrective action. Corrective action shall be performed to eliminate the source of contamination prior to proceeding with analysis. After the source of contamination has been eliminated, all samples in the analytical batch shall be repreped and reanalyzed. No analytical data shall be corrected for the presence of analytes in blanks. When an analyte is detected in the method blank and in the associated samples and corrective actions are not performed or are ineffective, the appropriate validation flag, as described in Sections 7.0 and 8.0, shall be applied to the sample results.

4.4.8 Ambient Blank

The ambient blank consists of ASTM Type II reagent grade water poured into a volatile organic compound (VOC) sample vial at the sampling site (in the same vicinity as the associated samples). It is handled like an environmental sample and transported to the laboratory for analysis. Ambient blanks are prepared only when VOC samples are taken and analyzed only for VOC analytes.

Ambient blanks are used to assess the potential introduction of contaminants from ambient sources (e.g., active runways, engine test cells, gasoline motors in operation, etc.) to the samples during sample collection.

The frequency of collection for ambient blanks is specified in Section 2.2.4 of the SAP. Ambient blanks shall be collected downwind of possible VOC sources.

4.4.9 Equipment Blank

An equipment blank is a sample of ASTM Type II reagent grade water poured into, over or pumped through the sampling device, collected in a sample container, and transported to the laboratory for analysis. Equipment blanks are used to assess the effectiveness of equipment decontamination procedures.

The frequency of collection for equipment blanks is specified in Section 2.2.4 of the SAP. Equipment blanks shall be collected immediately after the equipment has been decontaminated. The blank shall be analyzed for all laboratory analyses requested for the environmental samples collected at the site.

When an analyte is detected in the equipment blank the appropriate validation flag, as described in Section 8.0, shall be applied to all sample results from samples collected.

4.4.10 Trip Blank

The trip blank consists of a VOC sample vial filled in the laboratory with ASTM Type II reagent grade water, transported to the sampling site, handled like an environmental sample and returned to the laboratory for analysis. Trip blanks are not opened in the field. Trip blanks are prepared only when VOC samples are taken and are analyzed only for VOC analytes. Trip blanks are used to assess the potential introduction of contaminants from sample containers or during the transportation and storage procedures.

When an analyte is detected in the trip blank the appropriate validation flag, as described in Section 8.0, shall be applied to all sample results from samples in the cooler with the affected trip blank. One trip blank shall accompany each cooler of samples sent to the laboratory for analysis of VOCs.

4.4.11 Field Duplicates

A field duplicate sample is a second sample collected at the same location as the original sample. Duplicate samples are collected simultaneously or in immediate succession, using identical recovery techniques, and treated in an identical manner during storage, transportation, and analysis. The sample containers are assigned an identification number in the field such that they cannot be identified (blind duplicate) as duplicate samples by laboratory personnel performing the analysis. Specific locations are designated for collection of field duplicate samples prior to the beginning of sample collection.

Duplicate sample results are used to assess precision of the sample collection process. Precision of soil samples to be analyzed for VOCs is assessed from collocated samples because the compositing process required to obtain uniform samples could result in loss of the compounds of interest.

The frequency of collection for field duplicates is specified in Section 2.2.4 of the FSP.

4.4.12 Field Replicates

A field replicate sample, also called a split, is a single sample divided into two equal parts for analysis. The sample containers are assigned an identification number in the field such that they cannot be identified as replicate samples by laboratory personnel performing the analysis. Specific locations are designated for collection of field replicate samples prior to the beginning of sample collection. Replicate sample results are used to assess precision.

4.5 QUALITY CONTROL PROCEDURES

4.5.1 Holding Time Compliance

All sample preparation and analysis shall be completed within the method-required holding times. The holding time begins at the time of sample collection. Some methods have more than one holding time requirement (e.g., methods SW8080A, SW8270B, etc.). The preparation holding time is calculated from the time of sample collection to the time of completion of the sample preparation process as described in the applicable method, prior to any necessary extract cleanup and/or volume reduction procedures. If no preparation (e.g., extraction) is required, the analysis holding time is calculated from the time of sample collection to the time of completion of all analytical runs, including dilutions, second-column confirmations, and any required reanalyses. In methods requiring sample preparation prior to analysis, the analysis holding time is calculated from the time of preparation completion to the time of completion of all analytical runs, including dilutions, second-column confirmations, and any required reanalyses.

If holding times are exceeded and the analyses are performed, the results shall be flagged according to the procedures as described in Section 8.0.

4.5.2 Confirmation

Quantitative confirmation of results at or above the PQL for samples analyzed by GC or HPLC shall be required and shall be completed within the method-required holding times. For GC methods, with the exception of multi-response analytes, a second-column is used for confirmation. For HPLC methods, a second column or a different detector is used. The result of the first column/detector shall be the result reported. If holding times are exceeded and the analyses are performed, the results shall be flagged according to the procedures as described in Section 8.

4.5.3 Standard Materials

Standard materials used in calibration and to prepare samples shall be traceable to National Institute Standards and Technology (NIST), EPA, American Association of Laboratory Accreditation (A2LA) or other equivalent AFCEE-approved source, if available. If an NIST, EPA, or A2LA standard material is not available, the standard material proposed for use shall be included in an addendum to the SAP and approved before use. The standard materials shall be current, and the expiration policy described below shall be followed.

The expiration dates for ampulated solutions shall not exceed the manufacturer's expiration date or one year from the date of receipt, whichever comes first. Expiration dates for laboratory-prepared stock and diluted standards shall be no later than the expiration date of the stock solution, material, or the date calculated from the holding time allowed by the applicable analytical method, whichever comes first. Expiration dates for pure chemicals shall be established by the laboratory and be based on chemical stability, possibility of contamination, environmental conditions, and storage conditions. Expired standard materials shall be either revalidated prior to use or discarded. Revalidation may be performed through assignment of a true value and error window statistically derived from replicate analyses of the material as compared to an unexpired standard. The laboratory shall label standard and QC materials with expiration dates.

4.5.4 Supplies and Consumables

The laboratory shall inspect supplies and consumables prior to their use in analysis. The materials description in the methods of analysis shall be used as a guideline for establishing the acceptance criteria for these materials. Purity of reagents shall be monitored by analysis of LCSs. An inventory and storage system for these materials shall ensure use before manufacturers' expiration dates and storage under safe and chemically compatible conditions.

Intentionally Blank.

5.0 SAMPLING PROCEDURES

5.1 FIELD SAMPLING

The field sampling procedures for collecting samples and sampling methods shall be included in Section 6.0 of the FSP.

5.1.1 Sample Containers

Sample containers are purchased precleaned and treated according to EPA specifications for the methods. Sampling containers that are reused are decontaminated between uses by the EPA-recommended procedures (i.e., EPA 540/R-93/051). Containers are stored in clean areas to prevent exposure to fuels, solvents, and other contaminants. Amber glass bottles are used routinely where glass containers are specified in the sampling protocol.

5.1.2 Sample Volumes, Container Types, and Preservation Requirements

Sample volumes, container types, and preservation requirements for the analytical methods performed on AFCEE samples are listed in Table 5.1.2-1. The required sample volumes, container types, and preservation requirements for analytical methods proposed for project work not listed in Table 5.1.2-1 shall be included in an addendum to the FSP and approved by AFCEE before use.

Table 5.1.2-1 Requirements for Containers, Preservation Techniques, Sample Volumes, and Holding Times

Name	Analytical Methods	Cntnr[a]	Preserv.[b,c]	Minimum Sample Amount	Maximum Holding Time
Hydrogen ion (pH) (W, S)	SW9040/ SW9045	P, G	None required	N/A	Analyze immediately
Conductance	SW9050	P, G	None required	N/A	Analyze immediately
Temperature	E170.1	P, G	None required	N/A	Analyze immediately
Turbidity	E180.1	P, G	4°C	N/A	48 hours
Mercury	SW7470 SW7471	P, G, T	HNO_3 to pH < 2, 4°C	500 mL or 8 ounces	28 days (water and soil)
Metals (except chromium (VI) and mercury)	SW6010A SW6020 and SW-846 AA methods	P, G, T	HNO_3 to pH < 2, 4°C	500 mL or 8 ounces	180 days (water and soil)

Table 5.1.2-1 **Requirements for Containers, Preservation Techniques, Sample Volumes, and Holding Times** (Continued)

Name	Analytical Methods	Cntnr[a]	Preserv.[b,c]	Minimum Sample Amount	Maximum Holding Time
Total petroleum hydrocarbons (TPH)-volatile	SW8015 (modified)	G, Teflon-lined septum, T	4°C, HCl to pH < 2	2 x 40 mL or 4 ounces	14 days (water and soil); 7 days if unpreserved by acid
Total petroleum hydrocarbons (TPH)-extractable	SW8015 (modified)	G, amber, T	4°C	1 liter or 8 ounces	7 days until extraction and 40 days after extraction (water); 14 days until extraction and 40 days after extraction (soil)
Volatile aromatics	SW8020A	G, Teflon-lined septum, T	4°C, HCl to pH < 2, 0.008% $Na_2S_2O_3$	2 x 40 mL or 4 ounces	14 days (water and soil); 7 days if unpreserved by acid
Organochlorine pesticides and polychlorinated biphenyls (PCBs)	SW8080A, SW8081,	G, Teflon-lined cap, T	4°C, pH 5–9	1 liter or 8 ounces	7 days until extraction and 40 days after extraction (water); 14 days until extraction and 40 days after extraction (soil)
Semivolatile organics	SW8270B	G, Teflon-lined cap, T	4°C, 0.008% $Na_2S_2O_3$	1 liter or 8 ounces	7 days until extraction and 40 days after extraction (water); 14 days until extraction and 40 days after extraction (soil)
Volatile organics	SW8240B, SW8010B, SW8260A	G, Teflon-lined septum, T	4°C, 0.008% $Na_2S_2O_3$ (HCl to pH < 2 for volatile aromatics by SW8240 and SW8260)[b]	2 x 40 mL or 4 ounces	14 days (water and soil); 7 days if unpreserved by acid

a. Polyethylene (P); glass (G); brass sleeves in the sample barrel, sometimes called California brass (T).
b. No pH adjustment for soil.
c. Preservation with 0.008 percent $Na_2S_2O_3$ is only required when residual chlorine is present.

5.2 SAMPLE HANDLING AND CUSTODY

Procedures to ensure the custody and integrity of the samples begin at the time of sampling and continue through transport, sample receipt, preparation, analysis and storage, data generation and reporting, and sample disposal. Records concerning the custody and condition of the samples are maintained in field and laboratory records.

The contractor shall maintain chain-of-custody records for all field and field Quality Control (QC) samples. A sample is defined as being under a person's custody if any of the following conditions exist: (1) it is in their possession, (2) it is in their view, after being in their possession, (3) it was in their possession and they locked it up or, (4) it is in a designated secure area.

The following information concerning the sample shall be documented on the AFCEE chain-of-custody (COC) form (as illustrated in Section 8.0):

- Unique sample identification;
- Date and time of sample collection;
- Source of sample (including name, location, and sample type);
- Designation of MS/MSD;
- Preservative used;
- Analyses required;
- Name of collector(s)
- Pertinent field data (pH, temperature, etc.);
- Serial numbers of custody seals and transportation cases (if used);
- Custody transfer signatures and dates and times of sample transfer from the field to transporters and to the laboratory or laboratories; and
- Bill of lading or transporter tracking number (if applicable).

All samples shall be uniquely identified, labeled, and documented in the field at the time of collection in accordance with (IAW) Section 6.2 of the FSP.

Samples collected in the field shall be transported to the laboratory or field testing site as expeditiously as possible. When a 4 °C requirement for preserving the sample is indicated, the samples shall be packed in ice or chemical refrigerant to keep them cool during collection and transportation. During transit, it is not always possible to rigorously control the temperature of the samples. As a general rule, storage at low temperature is the best way to preserve most samples. A temperature blank (a volatile organics compounds sampling vial filled with tap water) shall be included in every cooler and used to determine the internal temperature of the cooler upon receipt of the cooler at the laboratory. When, in the judgment of the laboratory, the temperature of the samples upon receipt may have affected the stability of the analytes of interest, the problem shall be documented in laboratory records and discussed with AFCEE. The resolution of the problem shall also be documented.

Once the samples reach the laboratory, they shall be checked for anomalies against information on the COC form. The condition, temperature, and appropriate preservation of samples shall be checked and documented on the COC form. Checking an aliquot of the sample using pH paper is an acceptable procedure, except for VOCs where an additional sample is required to check preservation. The occurrence of any anomalies in the received samples and their resolution shall be documented in laboratory records. All sample information shall then be entered into a tracking system, and unique analytical sample identifiers shall be assigned. A copy of this information shall be reviewed by the laboratory for accuracy. Sample holding time tracking begins with the collection of samples and continues until the analysis is complete. Holding times for methods required routinely for AFCEE work are specified in Table 5.1.2-1. **Samples not preserved or analyzed in accordance with these requirements shall be resampled and analyzed, at no additional cost to AFCEE.** Subcontracted analyses shall be documented with a COC form that includes all the elements required by AFCEE, an example of which is provided in the FSP. Procedures ensuring internal laboratory COC shall also be implemented and documented by the laboratory. Specific instructions concerning the analysis specified for each sample shall be communicated to the analysts. Analytical batches shall be created, and laboratory QC samples shall be introduced into each batch.

While in the laboratory, samples shall be stored in limited-access, temperature-controlled areas. Refrigerators, coolers and freezers shall be monitored for temperature seven days a week. Acceptance criteria for the temperatures of the refrigerators and coolers is less than 8 °C. Acceptance criteria for the temperatures of the freezers shall be less then 0 °C. All of the cold storage areas shall be monitored by thermometers that have been calibrated with an NIST-traceable thermometer. As indicated by the findings of the calibration, correction factors shall be applied to each thermometer. Records that include acceptance criteria shall be maintained. Samples for volatile organics determination shall be stored separately from other samples, standards, and sample extracts. Samples shall be stored after analysis and then disposed of IAW applicable local, state, and federal regulations. Disposal records shall be maintained by the laboratory.

Standard operating procedures (SOPs) describing sample control and custody shall be maintained by the laboratory.

6.0 SCREENING ANALYTICAL METHODS

The analytical screening methods contained in this section are shown in Table 6-1. This section includes brief descriptions of the methods and QC required for screening procedures commonly used to conduct work efforts. The methods and QC procedures were taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (U.S. EPA SW-846, Third Edition, and its first and second update), *Methods for Chemical Analysis of Water and Waste* (U.S. EPA 1979), *ASTM Annual Book of Standards* (1993), and from manufacturer's literature.

Table 6-1. Screening Analytical Methods

Method	Parameter
SW846 (3550)	Moisture
SW9040	pH (water)
SW9050	Conductance
E170.1	Temperature
E180.1	Turbidity
Organic Vapor (FID and PID)	Soil gas screening-halogenated, aromatic, and petroleum hydrocarbons
ASTM D422	Particle size
Gas Chromatography	Passive Soil Gas
Modified 8015	Hydrocarbon Fingerprinting

6.1 ANALYTICAL SCREENING METHOD DESCRIPTIONS

This section contains subsections for each analytical procedure. Each subsection contains the following information:

- A brief method description; and
- The PQL (if applicable)

6.1.1 EPA Method SW9040 (Water)

Measurements of pH shall be performed for water samples using method SW9040. Measurements are determined electrometrically using either a glass electrode in combination with a reference potential, or a combination electrode.

6.1.2 EPA Method SW9050–Conductance

Standard conductivity meters are used for this analysis. The temperature is also measured and reported for this analysis.

6.1.3 EPA Method SW9060–Total Organic Carbon

Not Applicable.

6.1.4 EPA Method 160.1–Filterable Residue

Not Applicable.

6.1.5 EPA Method 160.2–Nonfilterable Residue

Not Applicable.

6.1.6 EPA Method 170.1–Temperature

Temperature measurements are made with a mercury-filled or dial type centigrade thermometer, or a thermistor.

6.1.7 EPA Method 180.1–Turbidity

This method is based on a comparison of the light scattered by the sample under defined conditions with the light intensity scattered by a standard reference suspension. The higher the intensity, the greater the turbidity. Turbidity measurements are made in a nephelometer and are reported in terms of nephelometric turbidity units (NTUs). The working range for the method is from 0 to 40 NTU. Higher levels of turbidity can be measured by diluting the sample with turbidity-free deionized water.

6.1.8 EPA Method 310.1–Alkalinity

Not Applicable.

6.1.9 EPA Method 360.1–Dissolved Oxygen

Not Applicable.

6.1.10 ASTM D422–Standard Method for Particle-Size Analysis of Soils

This method covers the quantitative determination of the distribution of particle sizes in soils. The distribution of particle sizes larger than 75 μm is determined by sieving (retained on the No. 200 sieve), while the distribution of particle sizes smaller than 75 μm is determined by a sedimentation process using a hydrometer.

6.1.11 ASTM D1498–Oxidation-Reduction Potential

Not Applicable.

6.1.12 ASTM D3416–Methane in Soil Gas

Not Applicable.

6.1.13 Draft Method SW4020–Screening for Polychlorinated Biphenyls by Immunoassay

Not Applicable.

6.1.14 Draft Method SW4030–Screening for Petroleum Hydrocarbons by Immunoassay

Not Applicable.

6.1.15 SW-846 (Described in Method SW3550)–Percent Moisture

Percent moisture is determined for solid samples undergoing analysis for inorganic and organic analytes. The sample is weighed, dried, and then reweighed. Percent moisture is calculated as:

$$\frac{\text{Initial Weight - Dried Weight}}{\text{Initial Weight}} \times 100 = \%\,\text{Moisture}$$

The moisture content is used to calculate results for soil samples on a dry weight basis using the calculation presented below:

$$\frac{\text{Result of analysis on wet weight basis}}{100\ -\ \%\,\text{Moisture}} = \text{Result of analysis on a dry weight basis}$$

All soil or sediment results and detection limits shall be reported on a dry weight basis.

6.1.16 Real-Time Portable Organic Vapor Analyzers

Two types of portable analyzers shall be used to perform real-time nonspecific analyses of hydrocarbon vapors. The instruments include a flame ionization detector (FID) (e.g., Foxboro Century OVA) and a photoionization detector (PID) (e.g., HNu® Systems [HNu®] trace gas analyzer) organic vapor monitor. One or more of these instruments may be used at a specific site, depending on the contaminant species of interest. When used together, the instruments provide complementary information because they are sensitive to different types of hydrocarbon vapors.

The portable analyzers shall be used as a screening tool to help determine the optimum locations for the collection of samples. Field data recorded on the COC forms give the laboratory analysts an indication of the approximate concentration of contaminants and aid in calculating dilution factors before analysis. Additionally, the real-time instruments are used to aid in selecting the proper level of personal protective equipment and monitoring air emissions during sampling activities. The comparability of results obtained from the PID and FID instruments can be considered only to be within the variability of this type of screening instrument. Comparability is greatest when the instruments are calibrated with the same standards and operated within similar concentration ranges.

The FID uses the principle of hydrogen flame ionization to detect and measure total hydrocarbon vapors. The FID has a dynamic operating range from 1 ppm by volume (ppmv) to 10 ppmv or 1 ppmv to 100,000 ppmv depending on the instrument, and provides a nonspecific response to total hydrocarbons. If concentrations exceed the range of the instrument, a dilution probe shall be attached to the FID to allow elevated vapor concentrations to be measured. The instrument is highly sensitive to compounds such as methane, benzene, and acetone, but is less sensitive to alcohols and halogenated compounds.

During operation, a sample is drawn into the probe and transmitted to the detection chamber by an internal pumping system. Inside the chamber, the sample is exposed to a hydrogen flame that ionizes the organic vapors. As the organic vapors burn, the ions produced are collected on an electrode in the chamber, and a current proportional to the hydrocarbon concentration is generated. This current is measured and displayed on the meter.

The PID detects and measures total hydrocarbon vapors. The instrument has an operating range of 0 to 2,000 ppm. During operation, a gas sample is drawn into the probe and past an ultraviolet light source by an internal pumping system. Contaminants in the sample are ionized, which produces an instrument response if their ionization potential is equal to or less than the ionizing energy supplied by the lamp. The radiation produces a free electron for each molecule of ionized contaminant, which generates a current directly proportional to the number of ions produced. This current is measured and displayed on the meter. The PID measures the total value for all species present with ionization potentials less than or equal to that of the lamp.

6.1.17 Passive Soil Gas Collection and Analysis

TEC will use GORE-SORBER ® Passive Sorbent Collection Devices (sorbers) to conduct the soil gas survey. The sorbers are typically 40 mm long with a 3 mm inside diameter, and contain 40 milligrams of a suitable granular absorbent material such as Tenax-TA ® and carbonaceous resins. These absorbent materials are typically used due to their affinity for a broad range of VOC and SVOCs. The sorbers are sheathed in the bottom of a 4 foot long vapor permeable insertion and retrieval cord. This construction is termed a GORE-SORBER Screening Module. Both the retrieval cord and sorbent container are constructed solely of inert, hydrophobic, microporous GORE-TEX® expanded polytetrafluoroethylene (ePTFE, similar to Teflon ®).

The ePTFE membranes are hydrophobic and exclude liquid water. However, they do not retard vapor transfer, thus allowing VOC and SVOC vapors to freely penetrate the screening module and collect on the adsorbent material. This ability to protect the sorbent media from contact with ground and soil pore water without retarding soil vapor diffusion facilitates application of soil vapor screening methods in very low permeability and poorly drained soils.

The soil gas screening modules will be installed by initially advancing a 0.75 to 1 inch diameter pilot hole to an average depth of 2 to 3 feet below ground surface using a slam bar or electric rotary hammer. After the pilot hole is advanced to the desired installation depth, the screening modules will be inserted into the completed pilot holes using a stainless steel insertion rod supplied by GORE. The top of each cord will be fastened to a cork, which is then tamped flush with the ground surface to facilitate retrieval of the module, and to seal the annulus of the pilot hole.

Modules will be analyzed at the laboratory of the manufacturer of the sorber modules, either by thermal desorption or solvent extraction coupled with gas chromatography and mass spectroscopy (GC/MS). Analytical instrumentation consists of Hewlett-Packard 5890 gas chromatographs, 5971A mass selective detectors, and Perkin-Elmer ATD-400 automated thermal desorption units. Sample preparation consists of removing the tip from the bottom of the sample module and transferring the exposed sorber to a thermal desorption unit for analysis. Sorbers remain clean and protected from dirt, soil, and groundwater by the insertion/retrieval cord, and do not require further sample preparation. Samples are placed in a freezer at minus 15 °C and remain frozen until analysis.

6.1.18 Hydrocarbon Fingerprinting

The hydrocarbon fingerprinting proposed is an interpretation of gas chromatographic analyses using pattern matching of GC traces. The samples are extracted and injected into a gas chromatograph where the sample is separated into its individual constituents based primarily on their boiling point. The individual constituents are detected with two detectors: a flame ionization detector (FID) and an electron capture detector (ECD). The FID is sensitive to components that burn in a flame, while the ECD is sensitive to components that readily give up electrons, such as those containing halogens, sulfur, or oxygen. Using the retention time of the constituents, and comparing the chromatographic patterns with a reference library of products, it is often possible to identify the type of product present.

6.2 CALIBRATION AND QC PROCEDURES FOR SCREENING METHODS

All screening data shall be flagged with an "S" data qualifier to show that the reported data are screening data (see Section 8.0). The other data qualifiers that shall be used with screening data are also shown in Table 6.2-1 and Section 8.0. Flagging criteria are applied (except for the "S" flag) when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

Table 6.2-1 presents the calibration and QC procedures for each method. These requirements as well as the corrective actions and data flagging criteria are included. In this table, the first two columns designate the method number and the class of analytes that may be determined by the method. The third column lists the method-required calibration and QC elements. The fourth column designates the minimum frequency for performing each calibration and QC element. The fifth column designates the acceptance criteria for each calibration and QC element. The sixth column designates the corrective action in the event that a calibration or QC element does not meet the acceptance criteria. The last column designates the data flagging criteria that must be applied in the event that the method-required calibration and QC acceptance criteria are not met.

6.2.1 Passive Soil Gas

A number of QA measures will be undertaken to assure sample representativeness. They include the following:

- All screening modules will be individually numbered and tracked through manufacturing, field deployment, and analytical procedures;
- Completed modules will be subjected to a 16-hour "bake-out" under a nitrogen blanket in a vacuum oven at 150 °C prior to shipment to the field site;
- Each module will be sealed in a clean glass vial with a Teflon liner, transported to the field site, and packed inside of coolers supplied by GORE;
- 5 to 10 percent additional trip blanks will accompany the modules to and from the site; and
- 5 percent of the modules will be installed in duplicate (placed in a separate hole within 1 foot of the original pilot hole).

Table 6.2-1. Summary of Calibration and QC Procedures for Screening Methods

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Data Flagging Criteria[b]
SW-846[c]	Moisture	Duplicate sample	1 per 20 samples	% solid RPD £ 15% RPD > 30%	Correct problem, repeat measurement. If still out, flag data	J R
SW9050	Conduct-ance	Calibration with KCl standard	Once per day at beginning of testing	± 5%	If calibration is not achieved, check meter, standards, and probe; recalibrate	R
		Field duplicate	10% of field samples	± 5%	Correct problem, repeat measurement	J
SW9040	pH (water)	2-point calibration with pH buffers	Once per day	± 0.05 pH units for every buffer	If calibration is not achieved, check meter, buffer solutions, and probe; replace if necessary; repeat calibration	R
		pH 7 buffer	At each sample location	± 0.1 pH units	Correct problem, recalibrate	R
		Field duplicate	10% of field samples	± 0.1 pH units	Correct problem, repeat measurement	J
E170.1	Temperature	Field duplicate	10% of field samples	± 1.0°C	Correct problem, repeat measurement	J
E180.1	Turbidity	Calibration with one formazin standard per instrument range used	Once per day at beginning of testing	± 5 units, 0–100 range ± 0.5 units, 0–0.2 range ± 0.2 units, 0–1 range	If calibration is not achieved, check meter; replace if necessary, recalibrate	R
		Field duplicate	10% of field samples	RPD £ 20%	Correct problem, repeat measurement	J

Table 6.2-1. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Data Flagging Criteria[b]
None	Organic vapor concen-trations (FID and PID)	2 point calibration	Monthly	Response ± 20% of expected value	Recalibrate; check instrument and replace if necessary	R
		Calibration verification and check	Daily at beginning and end of day	Response ± 20% of expected value	Correct problem, recalibrate	R
None	Passive soil gas	See Section 6.2.1	See Section 6.2.1	See Section 6.2.1	Correct problem, repeat measurement	J for field dup; R for others
8015 M	Hydrocarbon fingerprint	See Section 6.2.2	See Section 6.2.2	See Section 6.2.2	Correct problem, repeat measurement	R

a. All corrective actions shall be documented, and the records shall be maintained by the prime contractor.

b. All screening results shall first be flagged with an "S" and also any other appropriate validation flags identified in the Data Flagging Criteria column of the table. For example "SJ", "SB", "SR".

c. Described in method SW3550.

Laboratory QA/QC controls include instrument, manufacturing, and method blanks as well as calibration standards and tuning checks. Two instrument blanks, a sorber containing 5 micrograms bromofluorobenzene (BFB), and a method blank are analyzed at the beginning of each run sequence. The BFB mass spectra must meet the criteria set forth in the SOW for Organic Analysis Multi-Media Multi-Concentration (SOW OLM 010.0 and revisions) before samples are analyzed. A sorber containing BFB is also analyzed after every 30 samples and/or trip blanks, as is a method blank. Standards containing the selected target compounds at three calibration levels of 5, 20, and 50 micrograms are analyzed at the beginning of each run. The criterion for each target compounds is less than 35 percent RPD. If this criterion is not met for any target compound, the analyst has the option of generating second or third-order standard curves, as appropriate. A second-source reference standard, at a level of 20 micrograms per target compound, is analyzed after every 10 samples and/or trip blanks, and at the end of the run sequence. Positive identification of target compounds is determined by the presence of the target ion and at least two secondary ions, retention time versus reference standard, and the analyst's judgment. Data deliverables are provided for all samples and blanks analyzed.

6.2.2 Hydrocarbon Fingerprinting

The hydrocarbon fingerprinting technique is similar to a modified 8015 analysis, however it is not intended for quantitation, therefore some of the usual QA/QC measures are Not Applicable. Those that are used include the following:

- Method blank - one per 20 samples or analytical batch;
- Surrogates - used primarily to verify retention time; n-C25 pentacosane (FID) and dibutylchlorandate (ECD) are used; and
- Detection limit standards - a mixture of gas (20 ppm), diesel (50 ppm), and motor oil (100 ppm) are run every day to verify the chromatograms are readable.

7.0 DEFINITIVE DATA ANALYTICAL METHODS AND PROCEDURES

Section 7.1 contains brief descriptions of preparation methods. Section 7.2 contains subsections for each analytical procedure. Each subsection contains the following information:

- A brief method description;
- A table of PQLs;
- A table of QC acceptance criteria; and
- A table of calibration procedures, QC procedures, and data validation guidelines.

This information was obtained from the *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (U.S. EPA SW-846, Third Edition, and its first and second update); *Handbook for the Installation Restoration Program (IRP) Remedial Investigations and Feasibility Studies (RI/FS)* (Handbook), September 1993; *U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, U.S. EPA, Office of Solid Waste and Emergency Response, Washington, D.C., Publication 9240.1-05-01, EPA-540/R-94-013, PB94-963502, February 1994; and *U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, U.S. EPA, Office of Solid Waste and Emergency Response, Washington, D.C., Publication 9240.1-05, EPA-540/R-94-012, PB94-963501, February 1994. Definitions of terms are given in Section 4.0, and data validation guidelines are presented in Section 8.0.

7.1 Preparation Methods

Extraction and digestion procedures for liquid and solid matrices presented in this section are outlined in Table 7.1-1. The appropriate preparation method to be used (if applicable) for each analytical method is given in the PQL tables.

7.1.1 Method SW1311–Toxicity Characteristic Leaching Procedure

Not Applicable.

7.1.2 Method SW3005A–Acid Digestion of Water Samples for Metals Analysis

This method is an acid digestion procedure used to prepare water samples for metals analysis. The digested samples are analyzed for total recoverable and dissolved metals determination by either flame atomic absorption (FLAA) or inductively coupled plasma (ICP). For analysis of total recoverable metals, the entire sample is acidified at collection time. For analysis of dissolved metals, the samples are filtered then acidified upon collection.

Table 7.1-1. Extraction and Digestion Procedures

Method	Parameter
SW3005A	Acid Digestion of Water Samples for Metals Analysis
SW3010	Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by FLAA or ICP spectroscopy
SW3015	Microwave Assisted Acid Digestion of Aqueous Samples and Extracts
SW3020A	Acid Digestion of Aqueous Samples and Extracts for Metals Analysis
SW3050A	Acid Digestion for Solids, Sediments, and Sludges for Metals Analysis
SW3051	Microwave Assisted Acid Digestion of Sediments, Sludges Soils, and Oils
SW3520B	Continuous Liquid-Liquid Extraction
SW3540B/SW3541	Soxhlet Extraction
SW3550A	Ultrasonic Extraction
SW5030A	Purge and Trap Method

7.1.3 Method SW3020A– Acid Digestion of Aqueous Samples and Extracts for Metals Analysis

Method SW3020A prepares aqueous or waste samples for total metals determination by graphite furnace atomic absorption spectroscopy (GFAA). The samples are vigorously digested with acid and then diluted.

7.1.4 Method SW3050A–Acid Digestion for Solids, Sediments, and Sludges for Metals Analysis

Method SW3050A is applicable to the preparation of sediment, sludge, and soil samples for metals analysis by FLAA, GFAA or ICP. In this method the sample is digested then refluxed with acid. A separate aliquot of the sample is dried for a total solids and/or percent moisture determination.

7.1.5 Method SW3510B-Separatory Funnel Liquid-Liquid Extraction

Method SW3510B is designed to quantitatively extract nonvolatile and SVOCs from liquid samples using standard separatory funnel techniques. The sample and the extracting solvent must be immiscible in order to yield recovery of target compounds. Subsequent cleanup and detection methods are described in the organic analytical method used to analyze the extract.

7.1.6 Method SW3540B/SW3541-Soxhlet Extraction

Method SW3540B is a procedure for extracting nonvolatile and SVOCs from solids such as soils and sludges. Method SW3541 is an automated Soxhlet extraction. The Soxhlet extraction process ensures intimate contact of the sample matrix with the extraction solvent.

7.1.7 Method SW3550A-Ultrasonic Extraction

Method SW3550A is a procedure for extracting nonvolatile and SVOCs from solids such as soils and sludges. The sonication process ensures intimate contact of the sample matrix with the extraction solvent.

7.1.8 Method SW5030A-Purge and Trap Method

Method SW5030A describes sample preparation and extraction for the analysis of VOCs. The method is applicable to nearly all types of samples, including aqueous sludges, caustic liquors, acid liquors, waste solvents, oily wastes, water, tars, fibrous wastes, polymeric emulsions, filter cakes, spent carbons, spent catalysts, soils, and sediments. The success of this method depends on the level of interferences in the sample. Results may vary due to the large variability and complexity of matrices of solid waste samples.

An inert gas is bubbled through the sample solution at ambient temperature to transfer the volatile components to the vapor phase. The vapor is swept through a sorbent column where the volatile components are trapped. After purging is completed, the sorbent column is heated and backflushed with inert gas to desorb the components onto a GC column. For SW8020A, drying of the trap for under a helium flow is required. For methods SW8010B and SW8020A, the GC column is heated to elute the components that are detected by an appropriate detector.

7.1.9 Method SW3015-Microwave Assisted Acid Digestion of Aqueous Samples and Extracts

This digestion procedure can be used for the preparation of samples for analysis by FLAA, GFAA, ICP, or ICP-MS. A representative 45 mL aqueous sample is digested in 5 mL of concentrated nitric acid in a fluorocarbon (PFA or TFM) digestion vessel for 20 minutes using microwave heating. After the digestion process, the sample is cooled, and then filtered, centrifuged, or allowed to settle in a clean sample bottle prior to analysis.

7.1.10 Method SW 3051-Microwave Assisted Acid Digestion of Sediments, Sludges, Soils, and Oils

This is an alternative method to 3050 that provides a rapid multi-element acid leach digestion. A representative sample of up to 0.5 grams is digested in 10 mL of concentrated nitric acid for 10 minutes using microwave heating with a suitable laboratory microwave unit. The sample and acid are placed in a fluorocarbon (PFA or TFM) microwave vessel. The vessel is capped and heated in the microwave unit. After cooling, the vessel contents are filtered, centrifuged, or allowed to settle and then diluted to volume and analyzed by the appropriate SW-846 method.

7.1.11 Method SW 3010-Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by FLAA or ICP spectroscopy

This procedure is used for the determination of total metals. A mixture of nitric acid and the material to be analyzed is refluxed in a covered Griffin beaker. This step is repeated with additional portions of nitric acid until the digestate is light in color or until its color has stabilized. After the digestate has been brought to a low volme, it is refluxed with hydrochloric acid and brought up to volume.

7.1.12 Method 3520B-Continuous Liquid-Liquid Extraction

This method is a procedure for isolating organic compounds from aqueous samples and describes concentrating techniques. A measured volume of sample is placed into a continuous liquid-liquid extractor, adjusted if necessary to a specific pH, and extracted with organic solvent 18 to 24 hours. The extract is dried, concentrated (if necessary), and exchanged into a solvent compatible with the cleanup or determinative method being employed.

7.2 Analytical Procedures

The analytical procedures presented in this section are outlined in Table 7.2-1. For method SW8020A a reduced list of analytes will be targeted (the BTEX analytes) since chlorinated benzenes are not suspected as contaminants at the pipeline. For samples collected in the leachfield area, method 8240B will be used for analysis.

A brief description and three tables for each method are included in the following subsections. The first table presents the PQLs for each analyte in the method. The PQLs are presented for both soil and water matrices. The second table presents the acceptance criteria for the accuracy of spiked analyte and surrogate recoveries. This table also presents the acceptance criteria for the precision of matrix, field, and laboratory duplicate recoveries. The third table presents the calibration and QC procedures for each method. Corrective actions and data flagging criteria are also included in this table.

In the third table, the first two columns designate the method number and the class of analytes that may be determined by the method. The third column lists the method-required calibration and QC elements. The fourth column designates the minimum frequency for performing each calibration and QC element. The fifth column designates the acceptance criteria for each calibration and QC element. The sixth column designates the corrective action in the event that a calibration or QC element does not meet the acceptance criteria. The last column designates the data flagging criteria that shall be applied in the event that the method-required calibration and QC acceptance criteria are not met.

Table 7.2-1. Analytical Procedures

SW Methods	Parameter
8015 (modified)	TPH volatile and extractable (water and soil)
8020A	Aromatic volatile organics (water and soil)
8080A	Organochlorine pesticides and PCBs (water and soil)
8240B	Volatile organics (water and soil)
8270B	Semivolatile organics (water and soil)
6010A	Trace metals by ICP (water and soil)
7421	Lead (water and soil)
7470A	Mercury (water)
7471A	Mercury (soil)

7.2.1 Method SW8010B-Halogenated Volatile Organics

Not Applicable.

7.2.3 Method SW8015 (Modified)-Volatile and Extractable Total Petroleum Hydrocarbons

Volatile petroleum hydrocarbon components, such as gasoline, jet fuel, and other low molecular weight petroleum products, are analyzed by the direct purge and trap technique described in method SW5030 followed by a modified approach to method SW8015. Extractable TPH components are analyzed by extraction method SW3520B, SW3550A, or SW3510B followed by a modified method SW8015.

For volatile TPH, the sample is placed in the purge and trap sparge vessel and analysis is conducted using a GC equipped with an FID.

Extractable TPH components, such as kerosene, diesel, motor oil, and other high molecular weight extractable petroleum products, are analyzed by method SW3520B (continuous liquid/liquid extraction) for water-based matrices or by method SW3550A (sonication extraction) for soil/sludge matrices. The sample is extracted and analysis is accomplished on a GC equipped with a capillary or megabore column and an FID. PQLs for volatile TPH and extractable TPH are provided in Table 7.2.3-1.

Identification and quantitation of TPH components require more analytical judgment than other GC methods. The TPH chromatograms consist of groups of peaks that fall within a noted carbon retention time range (i.e., number of carbon atoms in the molecule). Standard fuel components are used to calibrate the instruments. The TPH results are reported in mg/kg or mg/L based on quantitation of the total area count for the gasoline range organics (i.e., C6-C13) or the diesel range organics (i.e., C13-C28). The retention time window shall be set such that the window encompasses only the C6 through C28 range of organics. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.3-2 and 7.2.3-3.

Table 7.2.3-1. PQLs for Method SW8015 (Modified)

Parameter/Method	Analyte	Water PQL	Water Unit	Soil PQL	Soil Unit
Petroleum Hydrocarbons SW5030/SW8015 (Mod)	Gasoline	0.1	mg/L	1.0	mg/kg
SW3550A/SW8015 (Mod)	Diesel, Jet Fuel	1.0	mg/L	10.0	mg/kg
SW3550A/SW8015 (Mod)					
SW3510B/SW8015 (Mod)					

Table 7.2.3-2. QC Acceptance Criteria for Method SW8015 (Modified)

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8015 (Modified) GRO	TPH–Gasoline	67–136	≤ 30	57–146	≤ 50
	Surrogate:				
	Fluorobenzene	75–125		70–130	
SW8015	TPH–Diesel	61–143	≤ 30	51–153	≤ 50
(Modified)	TPH–Jet Fuel	61–143	≤ 30	51–153	≤ 50
DRO					
	Surrogates:				
	Octacosane	26–152		25–162	
	Ortho-Terphenyl	57–132		47–142	

Table 7.2.3-3. QC Acceptance Criteria for Method SW8015 (Modified)

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW8015 (mod)	Volatile and Extractable Total Petroleum Hydrocarbons	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	Coefficient of determination ≥0.990	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Initial calibration verification	Daily, before sample analysis	All analytes within ±15% of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Continuing calibration verification	After every 10 samples and at the end of the analysis sequence	All analytes within ±15% of expected value	Correct problem then repeat initial calibration verification and reanalyze all samples since last successful calibration verification	Apply R to all results for specific analyte(s) for all samples since the last acceptable calibration
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.2.3-2	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst

Table 7.2.3-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW8015 (mod)	Volatile and Extractable Total Petroleum Hydrocarbons	Method blank	One per analytical batch	No TPH detected > PQL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for te specific analyte(s) in all samples in the associated analytical batch
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.2.3-2	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte(s) in all samples in the associated analytical batch; if the LCS %R > UCL, apply J to all positive results If the LCS %R < LCL, apply J to all positive results, apply R to all non-detects
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.2.3-2	Correct problem then reextract and analyze sample If matrix interference is confirmed, no further action is necessary	For the samples; if the %R > UCL for any surrogate, apply J to all positive results if the %R < LCL for any surrogate, apply J to all positive results, apply UJ to all non-detects If any surrogate recovery is < 10%, apply R to all results

Table 7.2.3-3. Concluded

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW8015 (mod)	Volatile and Extractable Total Petroleum Hydrocarbons	MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7.2.3-2	none	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if; (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3)MS/MSD RPD > CL
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.2.3-1	none	Apply R to all results for the specific analyte(s) in all samples analyzed
		Results reported between MDL and PQL	none	none	none	Apply F to all results between MDL and PQL

a. All corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.

b. Flagging criteria are applied by the data validator when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

7.2.4 Method SW8020A-Aromatic Volatile Organics

Aromatic volatile organics in water and soil samples are prepared using method SW5030 and analyzed using method SW8020A. This method (also known as the BTEX method since the compounds of interest include benzene, toluene, ethylbenzene, and xylene) is a purge and trap GC method. An inert gas is bubbled through a water matrix to transfer the volatile aromatic hydrocarbons from the liquid to the vapor phase. The aromatics are removed from the inert gas by passing the gas through a sorbent trap, which is then backflushed onto a GC column with a PID to separate and quantify the compounds of interest. Soil samples are first extracted. Low concentration contaminated soils may be prepared using method SW5030A. PQLs for method SW8020A are presented in Table 7.2.4-1. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.4-2 and 7.2.4-3.

Only a subset of the analytes listed in the method are proposed (the BTEX analytes) since chlorinated benzenes are not suspected as contaminants at the pipeline. For samples collected in the leachfield area, method 8240B will be used for analysis.

Table 7.2.4-1. PQLs for Method SW8020A

Parameter/Method	Analyte	Water PQL	Water Unit	Soil PQL	Soil Unit
Aromatic Volatile Organics SW5030A/SW8020A (W, S)	Benzene	2.0	µg/L	0.002	mg/kg
	MTBE	2.0	µg/L	0.002	mg/kg
	Ethylbenzene	2.0	µg/L	0.002	mg/kg
	Toluene	2.0	µg/L	0.002	mg/kg
	Xylenes, total	2.0	µg/L	0.002	mg/kg

Table 7.2.4-2. QC Acceptance Criteria for Method SW8020A

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8020A	Benzene	75–125	≤ 20	66–135	≤ 30
	Ethylbenzene	71–129	≤ 20	61–139	≤ 30
	MTBE	75-125	≤ 25	70-130	≤ 25
	Toluene	70–125	≤ 20	60–135	≤ 30
	Xylenes, total	71–133	≤ 20	61–143	≤ 30
	Surrogates:				
	Bromo-fluorobenzene	48–138		38–148	

Table 7.2.4-3. Summary of Calibration and QC Procedures for Method SW8020A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW8020A	Aromatic volatile organics	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	Coefficient of determination ≥0.990	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Second-source calibration verification	Once per five-point initial calibration	All analytes within ±15% of expected value	Correct problem then repeat initial calibration	Apply R to all results outside ±15% for specific analyte(s) for all samples associated with the calibration
		Retention time window calculated for each analyte	Each initial calibration	± 3 times standard deviation for each analyte retention time from 72-hour study	Correct problem then reanalyze all samples analyzed since the last retention time check	Apply R to all results for the specific analyte(s) in the sample
		Initial calibration verification	Daily, before sample analysis	All analytes within ±15% of expected value	Correct problem then repeat initial calibration	Apply R to all results outside ±30% and J between 15 and 30% for specific analyte(s) for all samples associated with the calibration
		Continuing calibration verification	After every 10 samples and at the end of the analysis sequence	All analytes within ±15% of expected value	Correct problem then repeat initial calibration verification and reanalyze all samples since last successful calibration verification	Apply R to all results outside ±15% for specific analyte(s) for all samples since the last acceptable calibration

Table 7.2.4-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW8020A	Aromatic volatile organics	Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.2.4-2	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst
		Method blank	One per analytical batch	No analytes detected > PQL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for te specific analyte(s) in all samples in the associated analytical batch
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.2.4-2	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte(s) in all samples in the associated analytical batch; if the LCS %R > UCL, apply J to all positive results if the LCS %R < LCL, apply J to all positive results, apply R to all non-detects
		Second-column confirmation	100% for all positive results at or above the PQL	Same as for initial or primary column analysis	Same as for initial or primary column analysis	Apply R to the result for the specific analyte(s) in the sample
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.2.4-1	none	Apply R to all results for the specific analyte(s) in all samples analyzed

Table 7.2.4-3. Concluded

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW8020A	Aromatic volatile organics	Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.2.4-2	Correct problem then reextract and analyze sample If matrix interference is confirmed, no further action is necessary	For the samples; if the %R > UCL for any surrogate, apply J to all positive results if the %R < LCL for any surrogate, apply J to all positive results, apply UJ to all non-detects If any surrogate recovery is < 10%, apply R to all results
		MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7.2.4-2	none	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if; (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3)MS/MSD RPD > CL
		Results reported between MDL and PQL	none	none	none	Apply F to all results between MDL and PQL

a. All corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.

b. Flagging criteria are applied by the data validator when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

7.2.5 Method SW8021A-Halogenated Volatile Organics

Not Applicable.

7.2.6 Method SW8070-Nitrosamines

Not Applicable.

7.2.7 Method SW8080A-Organochlorine Pesticides and Polychlorinated Biphenyls

Organochlorine pesticides and PCBs in water and soil samples are analyzed using method SW8080A. This analytical method involves extraction of water samples using a separatory funnel (method SW3510B) or using continuous liquid-liquid extraction (method SW 3520B). Extraction of solid samples is accomplished using ultrasonic extraction (method SW3550A) procedures. The pesticides and PCBs are separated and quantified by GC using electron capture detection. PQLs for this method are presented in Table 7.2.7-1. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.7-2 and 7.2.7-3.

Table 7.2.7-1. PQLs for Method SW8080A

Parameter/Method	Analyte	Water PQL	Water Unit	Soil PQL	Soil Unit
Organochlorine Pesticides	Aldrin	0.04	µg/L	0.003	mg/kg
and PCBs	α-BHC	0.03	µg/L	0.002	mg/kg
SW3510B or	β-BHC	0.06	µg/L	0.004	mg/kg
SW3520B/SW8080A(W)	δ-BHC	0.09	µg/L	0.006	mg/kg
SW3550A/SW8080A (S)	γ-BHC (Lindane)	0.04	µg/L	0.003	mg/kg
	Chlordane (technical)	0.14	µg/L	0.009	mg/kg
	4,4'-DDD	0.11	µg/L	0.007	mg/kg
	4,4'-DDE	0.04	µg/L	0.003	mg/kg
	4,4'-DDT	0.12	µg/L	0.008	mg/kg
	Dieldrin	0.02	µg/L	0.01	mg/kg
	Endosulfan I	0.14	µg/L	0.009	mg/kg
	Endosulfan II	0.04	µg/L	0.003	mg/kg
	Endosulfan Sulfate	0.66	µg/L	0.04	mg/kg
	Endrin	0.06	µg/L	0.004	mg/kg
	Endrin Aldehyde	0.23	µg/L	0.02	mg/kg
	Heptachlor	0.03	µg/L	0.002	mg/kg
	Heptachlor Epoxide	0.83	µg/L	0.06	mg/kg
	Methoxychlor	1.76	µg/L	0.1	mg/kg
	Toxaphene	2.4	µg/L	0.2	mg/kg
	PCB-1016	1.0	µg/L	1.0	mg/kg
	PCB-1221	1.0	µg/L	1.0	mg/kg
	PCB-1232	1.0	µg/L	1.0	mg/kg
	PCB-1242	1.0	µg/L	1.0	mg/kg
	PCB-1248	1.0	µg/L	1.0	mg/kg
	PCB-1254	1.0	µg/L	1.0	mg/kg
	PCB-1260	1.0	µg/L	1.0	mg/kg

Table 7.2.7-2. QC Acceptance Criteria for Method SW8080A

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8080A	Aldrin	47–125	≤ 30	37–135	≤ 50
	α-BHC	75–125	≤ 30	65–135	≤ 50
	β-BHC	51–125	≤ 30	41–133	≤ 50
	δ-BHC	75–126	≤ 30	65–136	≤ 50
	γ-BHC (Lindane)	73–125	≤ 30	63–135	≤ 50
	Chlordane (technical)	45–125	≤ 30	35–135	≤ 50
	4,4'-DDD	48–136	≤ 30	38–146	≤ 50
	4,4'-DDE	45–139	≤ 30	35–149	≤ 50
	4,4'-DDT	34–143	≤ 30	25–153	≤ 50
	Dieldrin	42–132	≤ 30	32–142	≤ 50
	Endosulfan I	49–143	≤ 30	39–153	≤ 50
	Endosulfan II	75–159	≤ 30	65–169	≤ 50
	Endosulfan Sulfate	46–141	≤ 30	36–151	≤ 50
	Endrin	43–134	≤ 30	33–144	≤ 50
	Endrin Aldehyde	75–150	≤ 30	65–160	≤ 50
	Heptachlor	45–128	≤ 30	35–138	≤ 50
	Heptachlor Epoxide	53–134	≤ 30	43–144	≤ 50
	Methoxychlor	73–142	≤ 30	63–152	≤ 50
	Toxaphene				
	PCB-1016	54–125	≤ 30	44–135	≤ 50
	PCB-1260	41–126	≤ 30	31–136	≤ 50
	Surrogates:				
	DCBP	34–133		34–133	
	TCMX	45–120		45–120	

Table 7.2.7-3. Summary of Calibration and QC Procedures for Method SW8080A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW8080A	Organo-chlorine pesticides and PCBs	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	Coefficient of Determination ≥0.990	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Second-source calibration verification	Once per five-point initial calibration	All analytes within ±15% of expected value	Correct problem then repeat initial calibration	Apply R to all results outside ±15% for specific analyte(s) for all samples associated with the calibration
		Retention time window calculated for each analyte	Each initial calibration	± 3 times standard deviation for each analyte retention time from 72-hour study	Correct problem then reanalyze all samples analyzed since the last retention time check	Apply R to all results for the specific analyte(s) in the sample
		Initial calibration verification	Daily, before sample analysis	All analytes within ±15% of expected value	Correct problem then repeat initial calibration	Apply R to all results outside ±15% for specific analyte(s) for all samples associated with the calibration
		Continuing calibration verification	After every 10 samples and at the end of the analysis sequence	All analytes within ±15% of expected value	Correct problem then repeat initial calibration verification and reanalyze all samples since last successful calibration verification	Apply R to all results outside ±15% for specific analyte(s) for all samples since the last acceptable calibration

Table 7.2.7-3 Continued.

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW8080A	Organo-chlorine pesticides and PCBs	Breakdown check (Endrin and DDT)	Daily prior to analysis of samples	Degradation ≤20%	Repeat breakdown check	Apply J to all positive DDT, DDE, DDD, endrin, endrin ketone and endrin aldehyde results; apply R to the analytes listed above if minimum frequency is not met; If breakdown products are present, R flag nondetects for DDT and endrin
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.2.7-2	Recalculate results; locate and fix problem with system and then rerun for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst
		Method blank	One per analytical batch	No analytes detected >PQL	Correct problem reprep and analyze method blank and all associated samples	Apply B to all results for te specific analyte(s) in all samples in the associated analytical batch
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.2.4-2	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte(s) in all samples in the associated analytical batch; if the LCS %R > UCL, apply J to all positive results if the LCS %R < LCL, apply J to all positive results, apply R to all non-detects

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW8080A	Organo-chlorine pesticides and PCBs	Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.2.7-2	Correct problem then reextract and analyze sample If matrix interference is confirmed, no further action is necessary	For the samples; if the %R > UCL for any surrogate, apply J to all positive results if the %R < LCL for any surrogate, apply J to all positive results, apply UJ to all non-detects If any surrogate recovery is < 10%, apply R to all results
		MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7.2.7-2	none	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if; (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3)MS/MSD RPD > CL

Table 7.2.7-3 Continued.

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW8080A	Organo-chlorine pesticides and PCBs	Second-column confirmation	100% for all positive results at or above the PQL	Same as for initial or primary column analysis	Same as for initial or primary column analysis	Apply R to the result for the specific analyte(s) in the sample
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.2.7-1	none	Apply R to all results for the specific analyte(s) in all samples analyzed
		Results reported between MDL and PQL	none	none	none	Apply F to all results between MDL and PQL

a. All corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.

b. Flagging criteria are applied by the data validator when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

7.2.8 Method SW8081-Organochlorine Pesticides and Polychlorinated Biphenyls

Not Applicable.

7.2.9 Method SW8140-Organophosphorus Pesticides

Not Applicable.

7.2.10 Method SW8141A-Organophosphorus Pesticides

Not Applicable.

7.2.11 Method SW8150B-Chlorinated Herbicides

Not Applicable.

7.2.12 Method SW8151-Chlorinated Herbicides

Not Applicable.

7.2.13 Method SW8240B-Volatile Organics

Volatile (or purgeable) organics in water and soil samples are analyzed using method SW8240B. This method uses a GC/mass spectrometry technique. Volatile compounds are introduced into the GC by purge and trap (SW5030A). An inert gas is bubbled through the water samples (or a soil-water slurry for soil samples) to transfer the purgeable organic compounds from the liquid to vapor phase. Soil samples with higher contaminant levels are extracted before purging. The vapor is then swept through a sorbent trap where the purgeable organics are trapped. The trap is backflushed and heated to desorb the purgeable organics onto a capillary GC column where they are separated and then detected with a mass spectrometer. The analytes detected and PQLs for this method are listed in Table 7.2.13-1.

Calibration—The mass spectrometer is tuned daily to give an acceptable spectrum for bromofluorobenzene (BFB). The tuning acceptance criteria are given in the following list as an ion abundance for each specified mass:

- 50-15 percent to 40 percent of mass 95
- 75-30 percent to 60 percent of mass 95
- 95-base peak, 100 percent relative abundance
- 96-5 percent to 9 percent of mass 95
- 173-0 percent to less than 2 percent of mass 174
- 174-greater than 50 percent of mass 95
- 175-5 percent to 9 percent of mass 174
- 176-greater than 95 percent, but less than 101 percent of mass 174
- 177-5 percent to 9 percent of mass 176

The IS method is used for quantitation of analytes of interest. For quantitation, RFs are calculated from the base ion peak of a specific IS that is added to each calibration standard, blank, QC sample, and sample. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.13-2 and 7.2.13-3.

Table 7.2.13-1. PQLs for Method SW8240B

Parameter/Method	Analyte	Water PQL	Water Unit	Soil PQL	Soil Unit
VOCs	1,1,1-TCA	5.0	µg/L	0.005	mg/kg
SW5030A/SW8240B	1,1,2,2-Tetrachloroethane	5.0	µg/L	0.005	mg/kg
(W, S)	1,1,2-TCA	5.0	µg/L	0.005	mg/kg
	1,1-DCA	5.0	µg/L	0.005	mg/kg
	1,1-DCE	5.0	µg/L	0.005	mg/kg
	1,2,3-Trichloropropane	5.0	µg/L	0.05	mg/kg
	1,2-DCA	5.0	µg/L	0.005	mg/kg
	1,2-Dichloropropane	5.0	µg/L	0.005	mg/kg
	2-Butanone	100.0	µg/L	0.1	mg/kg
	2-Chloroethyl Vinyl Ether	10.0	µg/L	0.01	mg/kg
	2-Hexanone	50.0	µg/L	0.05	mg/kg
	4-Methyl-2-Pentanone	50.0	µg/L	0.05	mg/kg
	Acetone	100.0	µg/L	0.1	mg/kg
	Benzene	5.0	µg/L	0.005	mg/kg
	Bromodichloromethane	5.0	µg/L	0.005	mg/kg
	Bromoform	5.0	µg/L	0.005	mg/kg
	Bromomethane	10.0	µg/L	0.01	mg/kg
	Carbon Disulfide	5.0	µg/L	0.005	mg/kg
	Carbon Tetrachloride	5.0	µg/L	0.005	mg/kg
	Chlorobenzene	5.0	µg/L	0.005	mg/kg
	Chloroethane	10.0	µg/L	0.01	mg/kg
	Chloroform	5.0	µg/L	0.005	mg/kg
	Chloromethane	10.0	µg/L	0.01	mg/kg
	Cis-1,2-DCE	5.0	µg/L	0.005	mg/kg
	Cis-1,3-Dichloropropene	5.0	µg/L	0.005	mg/kg
	Dibromochloromethane	5.0	µg/L	0.005	mg/kg
	Ethylbenzene	5.0	µg/L	0.005	mg/kg
	Methylene Chloride	5.0	µg/L	0.005	mg/kg
	Styrene	5.0	µg/L	0.005	mg/kg
	TCE	5.0	µg/L	0.005	mg/kg
	Tetrachloroethylene	5.0	µg/L	0.005	mg/kg
	Toluene	5.0	µg/L	0.005	mg/kg

Table 7.2.13-1. Concluded

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
VOCs	Trans-1,2-DCE	5.0	µg/L	0.005	mg/kg
SW5030A/SW8240B (W, S)	Trans-1,3-Dichloropropene	5.0	µg/L	0.005	mg/kg
	Vinyl Acetate	50.0	µg/L	0.05	mg/kg
	Vinyl Chloride	10.0	µg/L	0.01	mg/kg
	Xylenes (total all isomers)	5.0	µg/L	0.005	mg/kg

Table 7.2.13-2. QC Acceptance Criteria for Method SW8240B

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8240B	1,1,1-TCA	68–135	≤ 20	58–145	≤ 30
	1,1,2,2-Tetrachloroethane	55–138	≤ 20	45–148	≤ 30
	1,1,2-TCA	70–141	≤ 20	60–151	≤ 30
	1,1-DCA	62–141	≤ 20	52–151	≤ 30
	1,1-DCE	54–128	≤ 20	44–138	≤ 30
	1,2,3-Trichloropropane	75–140	≤ 20	66–150	≤ 30
	1,2-DCA	68–135	≤ 20	58–145	≤ 30
	1,2-Dichloropropane	75–132	≤ 20	66–142	≤ 30
	2-Butanone	50–163	≤ 20	40–173	≤ 30
	2-Chloroethyl Vinyl Ether	25–175	≤ 20	25–175	≤ 30
	2-Hexanone	47–165	≤ 20	37–175	≤ 30
	4-Methyl-2-Pentanone	75–125	≤ 20	67–135	≤ 30
	Acetone	43–165	≤ 20	33–175	≤ 30
	Benzene	51–139	≤ 20	41–149	≤ 30
	Bromodichloromethane	68–135	≤ 20	58–145	≤ 30
	Bromoform	67–129	≤ 20	57–139	≤ 30
	Bromomethane	49–125	≤ 20	39–135	≤ 30
	Carbon Disulfide	75–125	≤ 20	65–135	≤ 30
	Carbon Tetrachloride	67–125	≤ 20	57–135	≤ 30
	Chlorobenzene	59–140	≤ 20	49–150	≤ 30
	Dibromochloromethane	64–125	≤ 20	54–135	≤ 30
	Chloroethane	62–125	≤ 20	52–135	≤ 30
	Chloroform	65–129	≤ 20	55–139	≤ 30
	Chloromethane	38–125	≤ 20	28–135	≤ 30
	Cis-1,2-DCE	70–131	≤ 20	60–141	≤ 30
	Cis-1,3-Dichloropropene	70–125	≤ 20	60–135	≤ 30
	Ethylbenzene	59–140	≤ 20	49–150	≤ 30
	Methylene Chloride	55–126	≤ 20	45–136	≤ 30
	Styrene	71–133	≤ 20	61–143	≤ 30
	TCE	67–137	≤ 20	57–147	≤ 30
	Tetrachloroethylene	67–131	≤ 20	57–141	≤ 30

Table 7.2.13-2. Concluded

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8240B	Toluene	61–137	≤ 20	51–147	≤ 30
	Trans-1,2-DCE	61–138	≤ 20	51–148	≤ 30
	Trans-1,3-Dichloropropene	42–154	≤ 20	25–164	≤ 30
	Vinyl Acetate	75-125	≤ 20	65-135	≤ 30
	Vinyl Chloride	31-125	≤ 20	25-135	≤ 30
	Xylenes (total all isomers)	68-133	≤ 20	58-143	≤ 30
	Surrogates:				
	Toluene-D8	88–110		81–117	
	4-Bromofluorobenzene	86–115		74–121	
	1,2-DCA-D4	79–118		70–121	

Table 7.2.13-3. Summary of Calibration and QC Procedures for Method SW8240B

Method	Applic. Param.	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW8240B	Volatile Organics	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	SPCCs average RF ≥ 0.30[c]; and %RSD for all calibration analytes ≤ 30%	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Second-source calibration verification	Once per five-point initial calibration	All analytes within ±25% of expected value	Correct problem then repeat initial calibration	Apply R to all results outside ±25% for specific analyte(s) for all samples associated with the calibration
		Retention time window calculated for each analyte	Each initial calibration and calibration verifications	± 3 times standard deviation for each analyte retention time from 72-hour study	Correct problem then reanalyze all samples analyzed since the last retention time check	Apply R to all results for the specific analyte(s) in the sample
		Calibration verification	Daily, before sample analysis, every 12 hours of analysis time	SPCCs average RF ≥ 0.30[c]; and CCCs < 20% drift; and all calibration analytes within ±25% of expected value	Correct problem then repeat initial calibration	Apply R to all results not meeting acceptance criteria for RF and drift and outside ±25% expected value for all samples associated with the calibration
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.2.13-2	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst

Table 7.2.13-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW8240B	Volatile Organics	Check of mass spectral ion intensities using BFB	Prior to initial calibration and calibration verification	Refer to criteria listed in the method description (section 7.2.13)	Retune instrument and verify	Apply R to all results for all samples associated with the tune
		ISs	Immediately after or during data acquisition of calibration check standard	Retention time ±30 seconds: EICP area within -50% to +100% of last calibration verification (12 hours) for each	Inspect equip. for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning If matrix interference is confirmed, no further action is necessary	Apply R to all results for specific analytes for all samples outside ± 30 seconds; For EICP areas apply J for results outside -50 to +100% unless area <12.5% of last calibration - then apply R for all associated results
		Method blank	One per analytical batch	No analytes detected > PQL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for te specific analyte(s) in all samples in the associated analytical batch
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.2.13-2	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte(s) in all samples in the associated analytical batch; if the LCS %R > UCL, apply J to all positive results if the LCS %R < LCL, apply J to all positive results, apply R to all non-detects

Table 7.2.13-3 Concluded

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW8240B	Volatile Organics	Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.2.13-2	Correct problem then reextract and analyze sample If matrix interference is confirmed, no further action is necessary	For the samples; if the %R > UCL for any surrogate, apply J to all positive results if the %R < LCL for any surrogate, apply J to all positive results, apply UJ to all non-detects If any surrogate recovery is < 10%, apply R to all results
		MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7.2.13-2	none	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if; (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3) MS/MSD RPD > CL
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.2.13-1	none	Apply R to all results for the specific analyte(s) in all samples analyzed
		Results reported between MDL and PQL	none	none	none	Apply F to all results between MDL and PQL

a. All corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.

b. Flagging criteria are applied by the data validator when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

c. Except > 0.10 for bromoform

7.2.14 Method SW8260A-Volatile Organics

Not Applicable.

7.2.15 Method SW8270B-Semivolatile Organics

Semivolatile organics (also known as base/neutral and acid extractables) in water and soil samples are analyzed using method SW8270B. This technique determines quantitatively the concentration of a number of SVOCs. Aqueous samples are prepared using method SW3510B or SW 3520B, solid samples are prepared by method SW3550A or SW3540B. Samples are extracted and both base/neutral and acid extracts are then concentrated through evaporation. Compounds of interest are separated and quantified using a capillary column GC/mass spectrometer. The PQLs are listed in Table 7.2.15-1.

The mass spectrometer is tuned every 12 hours to give an acceptable spectrum for decafluorotriphenylphosphine (DFTPP). The tuning acceptance criteria are given in the following list as an ion abundance for each specified mass:

- 51-30 percent to 60 percent of mass 198
- 68-less than 2 percent of mass 69
- 70-less than 2 percent of mass 69
- 127-40 percent to 60 percent of mass 198
- 197-less than 1 percent of mass 198
- 198-base peak, 100 percent relative abundance
- 199-5 percent to 9 percent of mass 198
- 275-10 percent to 30 percent of mass 198
- 365-greater than 1 percent of mass 198
- 441-present, but less than mass 443
- 442-greater than 40 percent of mass 198
- 443-17 percent to 23 percent of mass 442

The IS method is used for quantitation of analytes of interest. For quantitation, RFs are calculated from the base ion peak of a specific IS that is added to each calibration standard, blank, QC sample, and sample. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.15-2 and 7.2.15-3.

Table 7.2.15-1 PQLs for Method SW8270B

Parameter/Method	Analyte	Water PQL	Water Unit	Soil PQL	Soil Unit
Semivolatile organics	1,2,4-Trichlorobenzene	10.0	µg/L	0.7	mg/kg
Base/Neutral Extractables	1,2-DCB	10.0	µg/L	0.7	mg/kg
SW3510B or SW3520B/SW8270B (W)	1,3-DCB	10.0	µg/L	0.7	mg/kg
SW3550A or SW3540B	1,4-DCB	10.0	µg/L	0.7	mg/kg
/SW8270B (S)	2,4-DNT	10.0	µg/L	0.7	mg/kg
	2,6-DNT	10.0	µg/L	0.7	mg/kg
	2-Chloronaphthalene	10.0	µg/L	0.7	mg/kg
	2-Methylnaphthalene	10.0	µg/L	0.7	mg/kg
	2-Nitroaniline	50.0	µg/L	3.3	mg/kg
	3-Nitroaniline	50.0	µg/L	3.3	mg/kg
	3,3'-Dichlorobenzidine	20.0	µg/L	1.3	mg/kg
	4-Bromophenyl phenyl ether	10.0	µg/L	0.7	mg/kg
	4-Chloroaniline	20.0	µg/L	1.3	mg/kg
	4-Chlorophenyl phenyl ether	10.0	µg/L	0.7	mg/kg
	4-Nitroaniline	50.0	µg/L	3.3	mg/kg
	Acenaphthylene	10.0	µg/L	0.7	mg/kg
	Acenapthene	10.0	µg/L	0.7	mg/kg
	Anthracene	10.0	µg/L	0.7	mg/kg
	Benz (a) anthracene	10.0	µg/L	0.7	mg/kg
	Benzo (a) pyrene	10.0	µg/L	0.7	mg/kg
	Benzo (b) fluoranthene	10.0	µg/L	0.7	mg/kg
	Benzo (g,h,i) perylene	10.0	µg/L	0.7	mg/kg
	Benzyl alcohol	20.0	µg/L	1.3	mg/kg
	Bis (2-chloroethoxy) methane	10.0	µg/L	0.7	mg/kg
	Bis (2-chlorethyl) ether	10.0	µg/L	0.7	mg/kg
	Bis (2-chloroisopropyl) ether	10.0	µg/L	0.7	mg/kg
	Bis (2-ethylhexyl) phthalate	10.0	µg/L	0.7	mg/kg
	Butyl benzylphthalate	10.0	µg/L	0.7	mg/kg
	Chrysene	10.0	µg/L	0.7	mg/kg
	Di-n-butylphthalate	10.0	µg/L	0.7	mg/kg
	Di-n-octylphthalate	10.0	µg/L	0.7	mg/kg

Table 7.2.15-1. Concluded

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
Semivolatile organics	Di-n-octylphthalate	10.0	µg/L	0.7	mg/kg
Base/Neutral Extractables	Dibenz (a,h) anthracene	10.0	µg/L	0.7	mg/kg
SW3510B/SW8270B(W)	Dibenzofuran	10.0	µg/L	0.7	mg/kg
SW3550A/SW8270B (S)	Diethyl phthalate	10.0	µg/L	0.7	mg/kg
(concluded)	Dimethly phthalate	10.0	µg/L	0.7	mg/kg
	Fluoranthene	10.0	µg/L	0.7	mg/kg
	Fluorene	10.0	µg/L	0.7	mg/kg
	Hexachlorobenzene	10.0	µg/L	0.7	mg/kg
	Hexachlorobutadiene	10.0	µg/L	0.7	mg/kg
	Hexachlorocyclopentadiene	10.0	µg/L	0.7	mg/kg
	Hexachloroethane	10.0	µg/L	0.7	mg/kg
	Indeno (1,2,3-cd) pyrene	10.0	µg/L	0.7	mg/kg
	Isophorone	10.0	µg/L	0.7	mg/kg
	n-Nitrosodiphenylamine	10.0	µg/L	0.7	mg/kg
	n-Nitrosodi-n-propylamine	10.0	µg/L	0.7	mg/kg
	Naphthalene	10.0	µg/L	0.7	mg/kg
	Nitrobenzene	10.0	µg/L	0.7	mg/kg
	Phenanthrene	10.0	µg/L	0.7	mg/kg
	Pyrene	10.0	µg/L	0.7	mg/kg
	2,4,5-Trichlorophenol	50.0	µg/L	3.3	mg/kg
	2,4,6-Trichlorophenol	10.0	µg/L	0.3	mg/kg
	2,4-Dichlorophenol	10.0	µg/L	0.3	mg/kg
	2,4-Dimethylphenol	10.0	µg/L	0.3	mg/kg
	2,4-Dinitrophenol	50.0	µg/L	3.3	mg/kg
	2-Chlorophenol	10.0	µg/L	0.3	mg/kg
	2-Methylphenol	10.0	µg/L	0.3	mg/kg
	2-Nitrophenol	10.0	µg/L	0.3	mg/kg
	4,6-Dinitro-2-methylphenol	50.0	µg/L	3.3	mg/kg
	4-Chloro-3-methylphenol	20.0	µg/L	1.3	mg/kg
	4-Methylphenol	10.0	µg/L	0.3	mg/kg
	4-Nitrophenol	50.0	µg/L	1.6	mg/kg
	Benzoic acid	50.0	µg/L	1.6	mg/kg
	Pentachlorophenol	50.0	µg/L	3.3	mg/kg
	Phenol	10.0	µg/L	0.3	mg/kg

Table 7.2.15-2. QC Acceptance Criteria for Method SW8270B

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8270B	1,2,4-Trichlorobenzene	44–142	≤ 20	34–152	≤ 30
	1,2-DCB	42–155	≤ 20	32–135	≤ 30
	1,3-DCB	36–125	≤ 20	26–135	≤ 30
	1,4-DCB	30–125	≤ 20	25–135	≤ 30
	2,4-DNT	39–139	≤ 20	29–149	≤ 30
	2,6-DNT	51–125	≤ 20	41–135	≤ 30
	2-Chloronaphthalene	60–125	≤ 20	50–135	≤ 30
	2-Methylnaphthalene	41–125	≤ 20	31–135	≤ 30
	2-Nitroaniline	40–135	≤ 20	30–145	≤ 30
	3,3'-Dichlorobenzidine	19–185	≤ 20	15–185	≤ 30
	3-Nitroaniline	41–135	≤ 20	31–145	≤ 30
	4-Bromophenyl phenyl ether	53–127	≤ 20	43–137	≤ 30
	4-Chloroaniline	35-146	≤ 20	25-156	≤ 30
	4-Chlorophenyl phenyl ether	51–132	≤ 20	41–142	≤ 30
	4-Nitroaniline	40–143	≤ 20	30–153	≤ 30
	Acenaphthylene	47–125	≤ 20	37–135	≤ 30
	Acenaphthene	49–125	≤ 20	39–135	≤ 30
	Anthracene	45–165	≤ 20	35–175	≤ 30
	Benz (a) anthracene	51–133	≤ 20	41–143	≤ 30
	Benzo (a) pyrene	41–125	≤ 20	31–135	≤ 30
	Benzo (b) fluoranthene	37–125	≤ 20	27–1 35	≤ 30
	Benzo (g,h,i) perylene	34–149	≤ 20	25–159	≤ 30
	Benzyl alcohol	35–125	≤ 20	25–135	≤ 30
	Bis (2-chloroethoxy) methane	49–125	≤ 20	39–135	≤ 30
	Bis (2-chloroethyl) ether	44–125	≤ 20	34–135	≤ 30
	Bis (2-chloroisopropyl) ether	36–166	≤ 20	26–175	≤ 30
	Bis (2-ethylhexyl) phthalate	33–129	≤ 20	25–139	≤ 30

Table 7.2.15-2. Continued

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8270B (Continued)	Butyl Benzyl Phthalate	26–125	≤ 20	25–135	≤ 30
	Chrysene	55–133	≤ 20	45–143	≤ 30
	Di-n-Butyl Phthalate	34–126	≤ 20	25–136	≤ 30
	Di-n-Octyl Phthalate	38–127	≤ 20	28–137	≤ 30
	Dibenz (a,h) Anthracene	50–125	≤ 20	40–135	≤ 30
	Dibenzofuran	52–125	≤ 20	42–135	≤ 30
	Diethyl Phthalate	37–125	≤ 20	27–135	≤ 30
	Dimethyl Phthalate	25–175	≤ 20	25–175	≤ 30
	Fluoranthene	47–125	≤ 20	37–135	≤ 30
	Hexachlorobenzene	46–133	≤ 20	36–143	≤ 30
	Hexachlorobutadiene	25–125	≤ 20	25–135	≤ 30
	Hexachlorocyclopentadiene	41–125	≤ 20	31–135	≤ 30
	Hexachloroethane	25–153	≤ 20	25–163	≤ 30
	Indeno (1,2,3-c,d) Pyrene	27–160	≤ 20	25–170	≤ 30
	Isophorone	26–175	≤ 20	25–175	≤ 30
	n-Nitrosodi-n-propylamine	37–125	≤ 20	27–135	≤ 30
	n-Nitrosodiphenylamine	27–125	≤ 20	25–135	≤ 30
	Naphthalene	50–125	≤ 20	40–135	≤ 30
	Nitrobenzene	46–133	≤ 20	36–143	≤ 30
	Phenanthrene	54–125	≤ 20	44–135	≤ 30
	Pyrene	47–136	≤ 20	37–146	≤ 30
	2,4,5-Trichlorophenol	15–185	≤ 20	15–185	≤ 30
	2,4,6-Trichlorophenol	29–138	≤ 20	19–148	≤ 30
	2,4-Dichlorophenol	36–135	≤ 20	26–145	≤ 30
	2,4-Dimethylphenol	35–149	≤ 20	25–159	≤ 30
	2,4-Dinitrophenol	As detected–161	≤ 20	As detected–171	≤ 30
	2-Chlorophenol	31–135	≤ 20	21–145	≤ 30
	2-Methylphenol	15–135	≤ 20	15–145	≤ 30
	2-Nitrophenol	34–135	≤ 20	24–145	≤ 30
	4,6-Dinitro-2-Methyl Phenol	16–144	≤ 20	15–154	≤ 30
	4-Chloro-3-Methyl Phenol	34–135	≤ 20	24–145	≤ 30
	4-Methylphenol	23–135	≤ 20	15–145	≤ 30
	4-Nitrophenol	15–141	≤ 20	15–151	≤ 30
	Benzoic Acid	As detected–172	≤ 20	As detected–182	≤ 30
	Pentachlorophenol	18–146	≤ 20	28–156	≤ 30
	Phenol	15–135	≤ 20	15–145	≤ 30

Table 7.2.15-2. Concluded

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8270B	*Surrogates:*				
(Concluded)	2,4,6-Tribromophenol	25–134		25–144	
	2-Fluorobiphenyl	43–125		34–135	
	2-Fluorophenol	25–125		25–135	
	Nitrobenzene-D5	32–125		25–135	
	Phenol-D5	25–125		25–135	
	Terphenyl-D14	42–126		32–136	

Table 7.2.15-3. Summary of Calibration and QC Procedures for Method SW8270B

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW8270B	Semi-volatile Organics	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	SPCCs ave. RF ≥ 0.05, and %RSD for all CCCs ≤30%; other cmpds ≤15% otherwise use quadratic fit	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Second-source calibration verification	Once per five-point initial calibration	All analytes within ±25% of expected value	Correct problem then repeat initial calibration	Apply R to all results outside ±25% for specific analyte(s) for all samples assoc. with the calibration
		Retention time window calculated for each analyte	Each initial calibration and calibration verifications	± 3 times standard deviation for each analyte retention time from 72-hour study	Correct problem then reanalyze all samples run since last retention time check	Apply R to all results for the specific analyte(s) in the sample
		Calibration verification	Daily, before sample analysis, every 12 hours of analysis time	SPCCs average RF ≥ 0.30[c]; and CCCs < 20% drift; and all calibration analytes within ±25% of expected value	Correct problem then repeat initial calibration	Apply R to all results not meeting acceptance criteria for RF and drift and outside ±25% expected value for all samples associated with the calibration
		Demonstrate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.2.15-2	Recalculate results; locate and fix problem with system then rerun for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst

Table 7.2.15-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW8270B	Semi-volatile Organics	Check of mass spectral ion intensities using BFB	Prior to initial calibration and calibration verification	Refer to criteria in the method description (Sec. 7.2.15)	Retune instrument and verify	Apply R to all results for all samples associated with the tune
		ISs	Immediately after or during data acquisition of calibration check standard	Retention time ±30 seconds: EICP area within -50% to +100% of last calibration verification (12 hours) for each	Inspect equip. for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning If matrix interference is confirmed, no further action is necessary	Apply R to all results for specific analytes for all samples outside ± 30 seconds; For EICP areas apply J for results outside -50 to +100% unless area <12.5% of last calibration - then apply R for all associated results
		Method blank	One per analytical batch	No analytes detected >PQL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte(s) in all samples in the associated analytical batch
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.2.15-2	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte(s) in all samples in the associated analytical batch; if the LCS %R > UCL, apply J to all positive results if the LCS %R < LCL, apply J to all positive results, apply R to all non-detects

Table 7.2.15-3. Concluded

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW8270B	Semi-volatile Organics	Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.2.15-2	Correct problem then reextract and analyze sample If matrix interference is confirmed, no further action is necessary	For the samples; if the %R > UCL for any surrogate, apply J to all positive results if the %R < LCL for any surrogate, apply J to all positive results, apply UJ to all non-detects If any surrogate recovery is < 10%, apply R to all results
		MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7.2.15-2	none	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if;(1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3) MS/MSD RPD > CL
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.2.15-1	none	Apply R to all results for the specific analyte(s) in all samples analyzed
		Results between MDL and PQL	none	none	none	Apply F to all results between MDL and PQL

a. All corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.

b. Flagging criteria are applied by the data validator when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

7.2.16 Method SW8280-Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans

Not Applicable.

7.2.17 Method SW8310–Polynuclear Aromatic Hydrocarbons

Not Applicable.

7.2.18 Method SW8330–Explosive Residues

Not Applicable.

7.2.19 Method SW6010A-Trace Elements (Metals) by Inductively Coupled Plasma Emission Spectroscopy for Water and Soil

Samples are analyzed for trace elements or metals using method SW6010A for water and soils. Analysis for most metals requires digestion of the sample. This digestion is performed by method SW3005A or SW3015 for water or method SW3050A or SW3051 for soil. Following digestion, the trace elements are determined simultaneously or sequentially using Inductively Coupled Plasma Emission Spectroscopy (ICPES). The elements and corresponding PQLs for this method are listed in Table 7.2.19-1. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.19-2 and 7.2.19-3.

Table 7.2.19-1. PQLs for Method SW6010A

Parameter/Method	Analyte	Water (mg/l)		Soil (mg/kg)	
		ICP PQL	Trace ICP PQL[a]	ICP PQL	Trace ICP PQL[a]
ICP Screen for Metals	Aluminum	0.5	0.05	50.0	5.0
SW3015 or SW3005A/	Antimony	0.4	0.01	40.0	1.0
SW6010A (W)	Arsenic	0.6	0.01	60.0	2.0
SW3051 or SW3050A/	Barium	0.02	0.005	2.0	0.5
SW6010A (S)	Beryllium	0.003	0.001	0.3	0.1
	Cadmium	0.04	0.001	4.0	0.1
	Calcium	0.1	0.5	10.0	50.0
	Chromium	0.07	0.005	7.0	0.5
	Cobalt	0.07	0.002	7.0	0.2
	Copper	0.06	0.005	6.0	0.5
	Iron	0.07	0.05	7.0	5.0
	Lead	0.5	0.01	50.0	1.0
	Magnesium	0.3	0.5	30.0	50.0
	Manganese	0.02	0.005	2.0	0.5
	Molybdenum	0.08	0.005	8.0	0.5
	Nickel	0.15	0.005	15.0	0.5
	Potassium	5.0	1.0	500.0	100.0
	Selenium	0.8	0.01	80.0	1.0
	Silver	0.07	0.005	7.0	0.2
	Sodium	0.3	1.0	30.0	100.0
	Thallium	0.4	0.02	40.0	2.0
	Vanadium	0.08	0.005	8.0	0.5
	Zinc	0.02	0.02	2.0	2.0

[a] Using ICP 3000XL

Table 7.2.19-2. QC Acceptance Criteria for Method SW6010A

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW6010A	Aluminum	80–120	≤ 15	80–120	≤ 25
	Antimony	80–120	≤ 15	80–120	≤ 25
	Arsenic	80–120	≤ 15	80–120	≤ 25
	Barium	80–120	≤ 15	80–120	≤ 25
	Beryllium	80–120	≤ 15	80–120	≤ 25
	Cadmium	80–120	≤ 15	80–120	≤ 25
	Calcium	80–120	≤ 15	80–120	≤ 25
	Chromium	80–120	≤ 15	80–120	≤ 25
	Cobalt	80–120	≤ 15	80–120	≤ 25
	Copper	80–120	≤ 15	80–120	≤ 25
	Iron	80–120	≤ 15	80–120	≤ 25
	Lead	80–120	≤ 15	80–120	≤ 25
	Magnesium	80–120	≤ 15	80–120	≤ 25
	Manganese	80–120	≤ 15	80–120	≤ 25
	Molybdenum	80–120	≤ 15	80–120	≤ 25
	Nickel	80–120	≤ 15	80–120	≤ 25
	Potassium	80–120	≤ 15	80–120	≤ 25
	Selenium	80–120	≤ 15	80–120	≤ 25
	Silver	80–120	≤ 15	80–120	≤ 25
	Sodium	80–120	≤ 15	80–120	≤ 25
	Thallium	80–120	≤ 15	80–120	≤ 25
	Vanadium	80–120	≤ 15	80–120	≤ 25
	Zinc	80–120	≤ 15	80–120	≤ 25

Table 7.2.19-3. Summary of Calibration and QC Procedures for Method SW6010A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW6010A	ICP Metals	Initial multipoint calibration (minimum 3 standards and a blank)	Daily initial calibration prior to sample analysis	Correlation coefficient ≥ 0.995 for linear regression	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Highest calibration standard	Before beginning a sample run	All analytes within ±5% of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Calibration blank	After every 10 samples and at end of the analysis sequence	No analytes detected >PQL	Correct problem then analyze calibration blank and previous 10 samples	Apply B to all results for specific analyte(s) in all samples associated with the blank
		Continuing calibration verification (Instrument Check Standard)	After every 10 samples and at the end of the analysis sequence	All analyte(s) within ±10% of expected value	Repeat calibration and reanalyze all samples since last successful calibration	Apply R to all results for the specific analyte(s) in all samples since the last acceptable calibration
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.2.19-2	Recalculate results; locate and fix problem with system and then rerun demonstratio n for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst

Table 7.2.19-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW6010A	ICP Metals	Method blank	One per analytical batch	No analytes detected >PQL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for specific analyte(s) in all samples associated with the blank
		Interference check solution (ICS)	At the beginning and end of an analytical run or twice during an 8 hour period, whichever is more frequent	Within ±20% of expected value	Terminate analysis; correct problem; reanalyze ICS; reanalyze all affected samples	Apply R to all results for specific analyte(s) in all samples associated with the ICS
		LCS for the analyte	One LCS per analytical batch	QC acceptance criteria, Table 7.2.19-2	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte(s) in all samples in the associated analytical batch; if the LCS %R > UCL, apply J to all positive results if the LCS %R < LCL, apply J to all positive results, apply R to all non-detects
		Dilution test	Each new sample matrix	1:4 dilution must agree within ±10% of the original determination	Perform post digestion spike addition	Apply J to all sample results if either of following exist: (1) new matrix check not run (2) RPD ≥10%

Table 7.2.19-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW6010A	ICP Metals	Post digestion spike addition	When dilution test fails	Recovery within 75-125% of expected results	Correct problem then reanalyze post digestion spike addition	Apply J to all sample results (for same matrix) for specific analyte(s) for all samples associated with the post digestion spike addition
		MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7.2.19-2	none	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if; (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3)MS/MSD RPD > CL
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.2.19-1	none	Apply R to all results for the specific analyte(s) in all samples analyzed
		Results reported between MDL and PQL	none	none	none	Apply J to all results between MDL and PQL

a. All corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.

b. Flagging criteria are applied by the data validator when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

7.2.20 Method SW6020—Trace Elements (Metals) by Inductively Coupled Plasma Mass Spectroscopy

Not Applicable.

7.2.21 Method SW7041—Graphite Furnace Atomic Absorption (Antimony)

Not Applicable.

7.2.22 Method SW7060A—Graphite Furnace Atomic Absorption (Arsenic)

Not Applicable.

7.2.23 Method SW7131A–Graphite Furnace Atomic Absorption (Cadmium)

Not Applicable.

7.2.24 Method SW7191–Graphite Furnace Atomic Absorption (Chromium)

Not Applicable.

7.2.25 Method SW7196-Hexavalent Chromium (Colorimetric)

Not Applicable.

7.2.26 Method SW7421–Graphite Furnace Atomic Absorption (Lead)

GFAA is used to measure low concentrations of metals in water and soil samples. The samples are extracted using method SW3020A, SW3015, SW3050A, or SW3051, as appropriate. Discrete aliquots of sample extract are deposited in a graphite tube furnace in microliter amounts. The graphite tube is heated resistively by an electrical current. The sample solution is dried and charred to remove sample matrix components and then atomized at temperatures sufficient to vaporize the Lead. Matrix modification is used to eliminate interference effects and may also enhance the vaporization efficiency and allow lower detection limits. PQLs for this analysis are listed in Table 7.2.26-1. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.26-2 and 7.2.26-3.

Table 7.2.26-1. PQLs for Method SW7421

		Water		Soil	
Parameter/Method	**Analyte**	**PQL**	**Unit**	**PQL**	**Unit**
SW3020A or SW3015/SW7421 (W) SW3050A or SW3051/SW7421 (S)	Lead	0.005	mg/L	0.5	mg/kg

Table 7.2.26-2. QC Acceptance Criteria for Method SW7421

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW7421	Lead	74-124	≤ 15	74-124	≤ 25

Table 7.2.26-3. Summary of Calibration and QC Procedures for Method SW7421

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW7421	Lead	Initial multipoint calibration (minimum 3 standards and a blank)	Daily initial calibration prior to sample analysis	Correlation coefficient ≥ 0.995 for linear regression	Correct problem then repeat initial calibration	Apply R to all results for specific analyte for all samples associated with the calibration
		Second-source calibration check standard	Once per initial daily multipoint calibration	Analyte within ±10% of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte for all samples associated with the calibration
		Calibration blank	Once per initial daily multipoint calibration	No analytes detected >PQL	Correct problem then reanalyze calibration blank and all samples associated with blank	Apply B to all results for specific analyte(s) in all samples associated with the blank
		Continuing calibration verification	After every 10 samples and at the end of the analysis sequence	The analyte within ±20% of expected value	Correct problem then repeat calibration and reanalyze all samples since last successful calibration	Apply R to all results for the specific analyte in all samples since the last acceptable calibration
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.2.26-2	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst
		Method blank	One per analytical batch	No analytes detected >PQL	Correct problem then reprep and analyze method blank and all samples processed with the blank	Apply B to all results for specific analyte(s) in all samples associated with the blank

Table 7.2.26-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW7421	Lead	LCS for the analyte	One LCS per analytical batch	QC acceptance criteria, Table 7.2.26-2	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte in all samples in the associated analytical batch; if the LCS %R > UCL, apply J to all positive results if the LCS %R < LCL, apply J to all positive results, apply R to all non-detects
		Matrix check (Post digestion spike)	Each sample	Recovery within 90-110% of expected value	Method of standard additions	Apply J to all sample results if either of following exist: (1) new matrix check not run (2) RPD ≥10%
		Recovery test	When new matrix check fails	Recovery within 85-115% of expected results	Run all samples by the method of standard addition	Apply J to all sample results (for same matrix) in which method of standard addition was not run when recovery outside of 85-115% range

Table 7.2.26-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW7421	Lead	MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7.2.26-2	none	For the specific analyte in all samples collected from the same site matrix as the parent, apply M if; (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3)MS/MSD RPD > CL
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.2.26-1	none	Apply R to all results for the specific analyte in all samples analyzed
		Results reported between MDL and PQL	none	none	none	Apply F to all results between MDL and PQL

a. All corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.

b. Flagging criteria are applied by the data validator when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

7.2.27 Method SW7470A/SW7471A–Mercury Manual Cold-Vapor Technique

Water and soil samples are analyzed for mercury using methods SW7470A and SW7471A, respectively. This method is a cold-vapor, flameless atomic absorption (AA) technique based on the absorption of radiation by mercury vapor. Mercury is reduced to the elemental state and aerated from solution in a closed system. The mercury vapor passes through a cell positioned in the light path of an AA spectrophotometer. Mercury concentration is measured as a function of absorbance. The PQLs for these methods are listed in Table 7.2.27-1. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.27-2 and 7.2.27-3.

Table 7.2.27-1. PQLs for Method SW7470A/SW7471A

Parameter/Method	Analyte	Water		Soil	
		PQL	Unit	PQL	Unit
SW7470A (W) SW7471A (S)	Mercury	0.001	mg/L	0.1	mg/kg

Table 7.2.27-2. QC Acceptance Criteria for Method SW7470A/SW7471A

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW7470A/ SW7471A	Mercury	77–120	≤ 15	77–120	≤ 25

Table 7.2.27-3. Summary of Calibration and QC Procedures for Method SW7470A/SW7471A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW7470A SW7471A	Mercury	Initial multipoint calibration (minimum 5 standards and a blank)	Daily initial calibration prior to sample analysis	Correlation coefficient ≥ 0.995 for linear regression	Correct problem then repeat initial calibration	Apply R to all results for specific analyte for all samples associated with the calibration
		Second-source calibration check standard	Once per initial daily multipoint calibration	Analyte within ±10% of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte for all samples associated with the calibration
		Calibration blank	Once per initial daily multipoint calibration	No analyte detected >PQL	Correct problem then reanalyze calibration blank and all samples associated with blank	Apply B to all results for specific analyte(s) in all samples associated with the blank
		Continuing calibration verification	After every 10 samples and at the end of the analysis sequence	The analyte within ±20% of expected value	Correct problem then repeat calibration and reanalyze all samples since last successful calibration	Apply R to all results for the specific analyte in all samples since the last acceptable calibration
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.2.27-2	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst

Table 7.2.27-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW7470A SW7471A	Mercury	Method blank	One per analytical batch	No analyte detected >PQL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for specific analyte(s) in all samples associated with the blank
		LCS for the analyte	One LCS per analytical batch	QC acceptance criteria, Table 7.2.27-2	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte in all samples in the associated analytical batch; if the LCS %R > UCL, apply J to all positive results if the LCS %R < LCL, apply J to all positive results, apply UJ to non-detects, R if %R <50
		New matrix check; five-fold dilution test	Each new sample matrix	Five times dilution sample result must be ±10% of the undiluted sample result	Perform recovery test	Apply J to all sample results if either of following exist: (1) new matrix check not run (2) RPD ≥10%
		Recovery test	When new matrix check fails	Recovery within 85-115% of expected results	Run all samples by the method of standard addition	Apply J to all sample results (for same matrix) in which method of standard addition was not run when recovery outside of 85-115% range

Table 7.2.27-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
SW7470A SW7471A	Mercury	MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7.2.27-2	none	For the specific analyte in all samples collected from the same site matrix as the parent, apply M if; (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3)MS/MSD RPD > CL
		MDL study	Once per year	Detection limits established shall be < the PQLs in Table 7.2.27-1	none	Apply R to all results for the specific analyte in all samples analyzed
		Results reported between MDL and PQL	none	none	none	Apply F to all results between MDL and PQL

a. All corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.

b. Flagging criteria are applied by the data validator when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

7.2.28 Method SW7740-Graphite Furnace Atomic Absorption (Selenium)

Not Applicable.

7.2.29 Method SW7841–Graphite Furnace Atomic Absorption (Thallium)

Not Applicable.

7.2.30 Method SW7911-Graphite Furnace Atomic Absorption (Vanadium)

Not Applicable.

7.2.31 Method SW9010A/SW9012-Total Cyanide and Cyanide Amenable to Chlorination

Not Applicable.

7.2.32 Method SW9056–Common Anions

Not Applicable.

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8.0 DATA REDUCTION, REVIEW, VERIFICATION, REPORTING, VALIDATION, AND RECORDKEEPING

The data reduction, review, reporting, and validation procedures described in this section will ensure; (1) complete documentation is maintained, (2) transcription and data reduction errors are minimized, (3) the data are reviewed and documented, and (4) the reported results are qualified if necessary. Laboratory data reduction and verification procedures are required to ensure that the overall objectives of analysis and reporting meet method and project specifications.

8.1 DATA REVIEW, VALIDATION, AND REPORTING REQUIREMENTS FOR SCREENING DATA

The analysts shall perform a 100 percent review of the screening data. The screening data methods are identified in Table 6-1 of Section 6.0. All screening data shall be qualified with an "S" flag and shall be further qualified if critical calibration and QC requirements are not acceptable. The calibration, QC requirements, corrective action requirements, and flagging criteria required are shown in Table 6.2-1 in Section 6.0. The flagging criteria are applied when acceptance criteria are not met and corrective action was not successful or corrective action was not performed. "S" designator flags shall be maintained in the final data qualification. When the data are reviewed and qualified, the analyst shall apply a final qualifier to any data that has been affected by multiple qualifiers. This final qualifier shall reflect the most severe qualifier that was applied to the data. The allowable final data qualifiers for screening data and the hierarchy of data qualifiers, listed in order of the most severe through the least severe, are "SR", "SJ", "SB", and "SU". Therefore, the allowable final data qualifiers for screening data are "SR", "SJ", "SB", "SU", and "S".

The definition of the data qualifiers are shown in Table 8.2-1. A summary of the flagging conventions of field screening methods is given in Table 6.2-1.

Table 8.2-1 Data Qualifiers

Qualifier	Description
J	The analyte was positively identified, the quantitation is an estimation.
U	The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL.
F	The analyte was positively identified but the associated numerical value is below the PQL.
R	The data are unusable due to deficiencies in the ability to analyze the sample and meet QC criteria.
B	The analyte was found in an associated blank, as well as in the sample.
M	A matrix effect was present (see tables in Section 7.0).
S	To be applied to all field screening data.
T	Tentatively identified compound (using GC/MS).

Screening data report packages shall be prepared for all field analyses as described in Section 8.8. The screening data shall be reported on the AFCEE screening data report forms (AFCEE Forms S-1 through S-3), as illustrated in Section 8.8. The prime contractor's project manager shall review the entire screening data report package with the field records. The prime contractor (1) shall determine if the data quality objectives have been met, and (2) shall calculate the data completeness for the project. These results shall be included in the data package deliverable.

8.2 DATA REVIEW, VALIDATION, AND REPORTING REQUIREMENTS FOR DEFINITIVE DATA

In each laboratory analytical section, the analyst performing the tests shall review 100 percent of the definitive data. After the analyst's review has been completed, 100 percent of the data shall be reviewed independently using the same criteria by a senior analyst or by the supervisor of the respective analytical section.

The definitive data methods are identified in Section 7.2. The calibration, QC requirements, corrective action requirements, and flagging criteria to be used for definitive data in this project are shown in the tables in Section 7.2. The flagging criteria are applied by the data validator when acceptance criteria are not met and corrective action is not successful or is not performed. Definitive data packages delivered to the prime contractor shall include all raw data. Analytical batch comments shall be added to the first page of the definitive data report packages to explain any nonconformance or other issues.

The laboratory QA/data review section shall review 10 percent of the completed data packages, and the laboratory project manager shall perform a sanity check review on all the completed data packages.

Data qualifiers according to Table 8.2-2 and the method-specific tables in Section 7.0 shall be added by the data validator after the first and second level of laboratory data reviews have been performed. All data will be checked to verify quantitation limits and determine if all results meet control limits, as specified for each of the methods in Section 7.0 of this QAPP.

When data are qualified, the data validator shall apply a final qualifier to any data that have been affected by multiple qualifiers. This final qualifier shall reflect the most severe qualifier that was applied to the data, i.e., all data will have only one data qualifying flag associate with it. The allowable final data qualifiers for definitive data and the hierarchy of data qualifiers, listed in order of the most severe through the least severe, are "R","M", "F", "J", "B", and "U". The definitions of the data qualifiers are shown in Table 8.2-1.

The one exception to these data flagging criteria rules applies to the tentatively identified compounds (TICs) that are identified only in the GC/MS methods. These TICs numerical results will always be qualified with only one flag for any reason, and that is the "T" flag.

The prime contractor's project manager shall review the entire definitive data report package, and with the field records, apply the final data qualifiers for the definitive data. The data validator shall apply data qualifying flags to each environmental field QC sample, e.g., ambient blanks, equipment blanks, trip blanks, field duplicates, matrix spike (MS) samples, and matrix spike duplicate (MSD) samples. The prime contractor shall review the field QC samples and field logs, and shall then appropriately flag any of the associated samples identified with

Table 8.2-2. General Flagging Conventions

QC Requirement	Criteria	Flag	Flag Applied To
Holding Time	Time exceeded for extraction or analysis	R	All analytes in the sample
Equipment Blank	Analyte(s) detected >PQL	B	The specific analyte(s) in all samples with the sampling date
Field duplicates	Field duplicates >PQLs AND RPD outside CL	J for positive and nondetects	Field duplicate pair
MS/MSD	MS or MSD %R >UCL or MS or MSD %R >LCL or MS/MSD RPD >CL	M for all results	The specific analyte(s) in all samples collected from the same site as the parent sample
Sample Preservation/ Collection	Preservation/collection requirements not met	R for all results	All analytes in the sample
Sample Storage	<2°C or> 6°C	J for positive results R for nondetects	All analytes in the sample
Quantitation	Analyte(s) detected ≥ MDL but < PQL	F	All affected results
Ambient Blank (VOC samples only)	Analyte(s) detected >PQL	B	The specific analyte(s) in all samples with the same matrix and sampling date
Trip Blank (VOC samples only)	Analyte(s) detected >PQL	B	The specific analyte(s) in all samples shipped in the same cooler

UCL = upper control limit

LCL = lower control limit

CL = control limit

the field QC sample, as explained in Table 8.2-2. For example, each matrix spike sample would only be qualified by the laboratory, while the prime contractor would apply the final qualifying flag for a matrix effect to all samples collected from the same site as the parent sample, Table 8.2-2.

The prime contractor shall determine if the data quality objectives have been met, and shall calculate the data completeness for the project. These results shall be included in the data package deliverable as described in Section 8.8.

8.3 QUALITY ASSURANCE REPORTS

The laboratory QA staff shall issue QA reports to the laboratory management, laboratory supervisors and task leaders. These reports shall describe the results of QC measurements, performance audits, systems audits, and confirmation sample comparisons performed for each sampling and analysis task. Quality problems associated with performance of methods, completeness of data, comparability of data including field and confirmatory data, and data storage shall be documented with the corrective actions that have been taken to correct the deficiencies identified.

8.4 IRPIMS ELECTRONIC DATA REPORTS

The prime contractor shall provide an electronic deliverable report in the Installation Restoration Program Information Management System (IRPIMS) format as specified by the SOW for the project.

IRPIMS is a data management system designed to accommodate all types of data collected for IRP projects. Specific codes and data forms have been developed to allow consistent and efficient input of information to the system. The database information shall be provided by the prime contractor via ASCII files in specified IRPIMS format on 3.5 inch floppy diskettes. The information transferred shall include all required technical data such as site information; well characteristics; and hydrogeologic, geologic, physical, and chemical analysis results. Electronic data reporting formats and requirements are given in the most current version of the *IRPIMS Data Loading Handbook.*

8.5 ARCHIVING

Hard copy and electronic data shall be archived in project files and on electronic archive tapes for the duration of the project or a minimum of 5 years, whichever is longer.

8.6 PROJECT DATA FLOW AND TRANSFER

The data flow from the laboratory and field to the project staff and data users shall be sufficiently documented to ensure the data are properly tracked, reviewed, and validated for use.

8.7 RECORDKEEPING

The laboratory shall maintain electronic and hard copy records sufficient to recreate each analytical event conducted pursuant to the SOW. The minimum records the laboratory shall keep will contain the following:

- COC forms;

- Initial and continuing calibration records including standards preparation traceable to the original material and lot number;
- Instrument tuning records (as applicable);
- Method blank results;
- IS results;
- Surrogate spiking records and results (as applicable);
- Spike and spike duplicate records and results;
- Laboratory records;
- Raw data, including instrument printouts, bench work sheets, and/or chromatograms with compound identification and quantitation reports;
- Corrective action reports;
- Other method and project required QC samples and results; and
- Laboratory-specific written SOPs for each analytical method and QA/QC function in place at the time of analysis of project samples.

8.8 HARD COPY DATA REPORTS FOR SCREENING AND DEFINITIVE DATA

The hard copy data reports shall conform to the formats identified in this section.

A screening data report package shall consist of the following AFCEE forms: S-1, S-2, and S-3.

A definitive data inorganic report package shall consist of the following AFCEE forms: I-1, I-2, I-3, I-4, I-5, I-6, I-7, I-8 and I-9.

A definitive data organic report package shall consist of the following AFCEE forms: O-1, O-2, O-3, O-4, O-5, O-6, O-7, O-8, O-9 and O-10.

Exceptions to these report forms are as follows: for mercury analysis, form I-3A will be substituted for form I-3 in the inorganic report package; for cyanide analysis, form I-3B will be substituted for form I-3 in the inorganic report package; for GC/MS analyses, form O-5A will be added to the organic report package. All forms and instructions for completing are contained in the Appendix A.

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9.0 SYSTEMS AND PERFORMANCE AUDITS, PERFORMANCE EVALUATION PROGRAMS, MAGNETIC TAPE AUDITS, AND TRAINING

Technical systems and performance audits shall be performed as independent assessments of sample collection and analysis procedures. Audit results will be used to evaluate the ability of an analytical contractor to (1) produce data that fulfill the objectives established for the program, (2) comply with the QC criteria, and (3) identify any areas requiring corrective action. The systems audit is a qualitative review of the overall sampling or measurement system, while the performance audit is a quantitative assessment of a measurement system. Full data validation is also a quantitative check of the analytical process, where all documentation and calculations are evaluated and verified. Data validation is discussed in Section 8.

9.1 PROJECT AUDITS

9.1.1 State/Federal Project Audits

Audits by various state and Federal agencies are commonly conducted for the laboratories that will analyze project samples. Audit reports from these agencies shall be reviewed by the prime contractor to determine whether data produced by the analytical contractor shall fulfill the objectives of the program.

Audit findings shall be transmitted to the prime contractor and to AFCEE. The prime contractor shall review the audit findings and provide a written report to AFCEE. This report shall include the recommended corrective actions or procedures to correct the deficiencies identified during the state/Federal audits(s). The audit results and discussion shall be incorporated into the QA report for each sampling effort.

9.1.2 Technical Systems Audits

A technical systems audit is an on-site, qualitative review of the sampling or analytical system to ensure that the activity is being performed in compliance with the Sampling and Analysis Plan (SAP) specifications. Sampling and field procedures, and the analytical laboratories shall be audited by the prime contractor at the beginning of the field work. A laboratory systems audit shall be performed by AFCEE if previous audit reports indicate that corrective actions are outstanding, a recent audit has not been conducted, or quality concerns have arisen based upon the use of that laboratory for other projects. The laboratory systems audit results will be used to review laboratory operation and ensure the technical procedures and documentation are in place and operating to provide data that fulfill the project objectives and to ensure outstanding corrective actions have been addressed.

Critical items for a laboratory or field systems audit include:

- Sample custody procedures;
- Calibration procedures and documentation;
- Completeness of data forms, notebooks, and other reporting requirements;
- Data review and validation procedures;
- Data storage, filing, and record keeping procedures;

- QC procedures, tolerances, and documentation;
- Operating conditions of facilities and equipment;
- Documentation of training and maintenance activities,
- Systems and operations overview; and
- Security of laboratory automated systems.

Critical items for a sampling systems audit include:

- Calibration procedures and documentation for field equipment;
- Documentation in field log books and sampling data sheets;
- Organization and minimization of potential contamination sources while in the field;
- Proper sample collection, storage, and transportation procedures; and
- Compliance with established COC and transfer procedures.

After each on-site audit, a debriefing session will be held for all participants to discuss the preliminary audit results. The auditor will then complete the audit evaluation and submit an audit report including observations of the deficiencies and the necessary recommendations for corrective actions. Compliance with the specifications presented in the SAP will be noted and noncompliance or deviations shall be addressed in writing by the prime contractor to AFCEE with corrective actions and a time frame for implementation of the corrective actions. Follow-up audits will be performed prior to completion of the project to ensure that corrective actions have been taken.

9.1.3 Project-Specific Performance Evaluation Audits

Not Applicable.

9.1.4 Magnetic Tape Audits

Not Applicable.

9.1.5 Performance Evaluation Sample Programs

All laboratories shall participate in the USEPA performance evaluation (PE) Water Supply and Water Pollution Studies programs or equivalent programs for state certifications. Satisfactory performance in these nonproject-specific PE programs also demonstrate proficiency in methods used to analyze AFCEE samples. The laboratory shall document the corrective actions to unacceptable PE results to demonstrate resolution of the problems.

9.2 TRAINING

Not Applicable.

10.0 PREVENTIVE MAINTENANCE

A preventive maintenance program shall be in place to promote the timely and effective completion of a measurement effort. The preventive maintenance program is designed to minimize the downtime of crucial sampling and/or analytical equipment due to unexpected component failure. In implementing this program, efforts are focused in three primary areas: (1) establishment of maintenance responsibilities, (2) establishment of maintenance schedules for major and/or critical instrumentation and apparatus, and (3) establishment of an adequate inventory of critical spare parts and equipment.

10.1 MAINTENANCE RESPONSIBILITIES

Maintenance responsibilities for equipment and instruments are assumed by the respective facility managers. The managers then establish maintenance procedures and schedules for each major equipment item. This responsibility may be delegated to laboratory personnel, although the managers retain responsibility for ensuring adherence to the prescribed protocols.

10.2 MAINTENANCE SCHEDULES

The effectiveness of any maintenance program depends to a large extent on adherence to specific maintenance schedules for each major equipment item. Other maintenance activities are conducted as needed. Manufacturers' recommendations provide the primary basis for the established maintenance schedules, and manufacturer's service contracts provide primary maintenance for many major instruments (e.g., GC/mass spectrometry instruments, AA spectrometers, and analytical balances).

10.3 SPARE PARTS

Along with a schedule for maintenance activities, an adequate inventory of spare parts is required to minimize equipment downtime. The inventory includes those parts (and supplies) that are subject to frequent failure, have limited useful lifetimes, or cannot be obtained in a timely manner should failure occur.

Field sampling task leaders and the respective laboratory managers are responsible for maintaining an adequate inventory of spare parts. In addition to spare parts and supply inventories, the contractor shall maintain an in-house source of backup equipment and instrumentation.

10.4 MAINTENANCE RECORDS

Maintenance and repair of major field and laboratory equipment shall be recorded in field or laboratory log books. These records shall document the serial numbers of the equipment, the person performing the maintenance or repairs, the date of the repair, the procedures used during the repair, and proof of successful repair prior to the use of the equipment.

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11.0 CORRECTIVE ACTION

Requirements and procedures for documenting the need for corrective actions are described in this section.

11.1 CORRECTIVE ACTION REPORT

Problems requiring corrective action in the laboratory are documented by the use of a corrective action report. The QA coordinator or any other laboratory member can initiate the corrective action request in the event QC results are unacceptable, or upon identification of some other laboratory problem. Corrective actions can include reanalysis of the sample or samples affected, resampling and analysis, or a change in procedures, depending upon the severity of the problem.

11.2 CORRECTIVE ACTION SYSTEM

A system for issuing, tracking, and documenting completion of formal Recommendations for Corrective Action (RCA) exists for addressing significant and systematic problems. Recommendations for corrective actions are issued only by a member of the QA group, or a designee in a specific QA role. Each RCA addresses a specific problem or deficiency, usually identified during QA audits of laboratory or project operations. An RCA requires a written response from the party to whom the RCA was issued. A summary of unresolved RCAs is included in the monthly QA report to management. The report lists all RCAs that have been issued, the manager responsible for the work area, and the current status of each RCA. An RCA requires verification by the QA group that the corrective action has been implemented before the RCA is considered to be resolved. In the event there is no response to an RCA within 30 days, or if the proposed corrective action is disputed, the recommendation and/or conflict is pursued to successively higher management levels until the issue is resolved.

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12.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

At a minimum, the laboratory QA coordinator shall prepare a quarterly summary report of the status of the project, of QA/QC problems, corrective actions taken, and unresolved RCAs with recommended solutions for management. The report shall also include results from all PE samples, audit findings, and periodic data quality assessments. This report shall be available for review by AFCEE auditors upon request.

APPENDIX A

AFCEE HARD COPY REPORT FORMS

INSTRUCTIONS FOR COMPLETING AFCEE REPORT FORMS

The following instructions shall be used in completing the AFCEE report forms for screening and definitive data. The bold lettering identifies the fields on the AFCEE report form.

ALL INORGANIC AND ORGANIC FORMS

Analytical Method: enter the method name (e.g., SW6010A, SW8270B)

AAB#: enter the unique AFCEE analytical batch number (see Section 4.4 of the AFCEE QAPP for a definition of a batch)

Lab Name: enter the laboratory name (e.g., Garland Labs, Inc.)

Contract#: enter the Air Force contract number and delivery order number under which the analytical work is being performed (e.g., F21625-94-D-8005/0001)

Comments: any comments

FORM I-1

Base/Command: enter the base name and the Air Force command (e.g., Banks AFB/SPACECOM)

Prime Contractor: enter the name of the prime contractor (e.g., RDS, Inc)

Field Sample ID: enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

Lab Sample ID: enter the unique identifying number given to the sample by the laboratory that corresponds to the Field Sample ID

FORM I-2

Field Sample ID: enter the unique identifying number given to the field sample includes MS, MSD, field duplicate and field blanks)

Lab Sample ID: enter the unique identifying number given to the sample by the laboratory that corresponds to the Field Sample ID

Matrix: enter the sample matrix (e.g., water, soil)

% Solids: enter the % solids

Dilution: enter the dilution (if applicable) (e.g., 1:5)

Date Received/Extracted/Analyzed: enter the appropriate dates in the format DD-MMM-YY(e.g., 3 Jun 96)

FORM I-2 (continued)

Concentration Units: enter the appropriate units (i.e., µg/L or mg/kg)

MDL: enter the laboratory derived method detection limit

PQL: enter the project practical quantitation limit as stated in the QAPP or approved variance for each analyte

Concentration: enter the result

Qualifier: enter the qualifier flag (see QAPP Sections 7 and 8)

FORM I-3

Instrument ID: enter the instrument identifier (e.g., the serial number or other identifying number/name)

Date of Calibration: enter the appropriate date in the format DD-MMM-YY (e.g., 3 June 96)

RF Blank, RF1, RF2, RF3: enter the response factor corresponding to the standard with the same number: RF Blank is the response factor for the blank

Std1, Std2, Std3: enter the concentration of the standard

r: enter the correlation coefficient

Q: enter a "*" for all corresponding correlation coefficients that were not acceptable as per QAPP Section 7

FORM I-3A **(Mercury analyses only) and I-3B (cyanide analyses only)**

Instrument ID: enter the instrument identifier (e.g., the serial number or other identifying number/name)

Date of Calibration: enter the appropriate date in the format DD-MMM-YY (e.g., 3 June 96)

RF Blank, RF1, RF2, RF3, RF4, RF5, RF6: enter the response factor corresponding to the standard with the same number: RF Blank is the response factor for the blank

Std 1, Std 2, Std 3, Std 4, Std 5, Std 6: enter the concentration of the standard

r: enter the correlation coefficient

Q: enter a "*" for all corresponding correlation coefficients that were not acceptable as per QAPP Section 7

FORM I-4

Instrument ID: enter the instrument identifier (e.g., the serial number or other identifying number/name)

Date of Calibration: enter the appropriate date in the format DD-MMM-YY (e.g., 3 June 96)

Highest Std ID: enter the unique identifier for the highest standard such that the standard could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., HS960603)

2nd Source ID: enter the unique identifier for the 2nd source standard such that the standard could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., 2S960603)

CCV #1 ID: enter the unique identification number for the first CCV such that the CCV could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., CCV960603-1)

CCV #2 ID: enter the unique identification number for the second CCV such that the CCV could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., CCV960603-2)

Expected, Expected 1: enter the expected result (i.e., the concentration of the calibration material)

Found, Found 1, Found 2: enter the measured result

%D: enter the per cent difference between the expected and found

Q: enter a "*" for all %Ds that were not acceptable as per QAPP Section 7

FORM I-5

Units: enter the appropriate units (i.e., µg/L or mg/kg)

Calibration Blank ID: enter the identification number for the calibration blank (the same ID number will be found in the run sequence log, e.g., CB960603)

Method Blank ID: enter the identification number for the method blank (the same ID number will be found in the run sequence log, e.g., MB960603)

CCB #1 ID: enter the identification number for the first CCB (the same ID number will be found in the run sequence log, e.g., CCB960603-1)

CCB #2 ID: enter the identification number for the second CCB (the same ID number will be found in the run sequence log, e.g., CCB960603-2)

FORM I- 5 (Continued)

CCB #1 ID: enter the identification number for the third CCB (the same ID number will be found in the run sequence log, e.g., CCB960603-3)

Calibration Blank: enter the result for the calibration blank

Continuing Calibration Blank 1: enter the result for the continuing calibration blank 1

Continuing Calibration Blank 2: enter the result for the continuing calibration blank 2

Continuing Calibration Blank 3: enter the result for the continuing calibration blank 3

Method Blank: enter the result for the method blank

PQL: enter the project practical quantitation limit as stated in the QAPP or approved variance for each analyte

Q: enter a "*" for all calibration and method blank analytes that were not acceptable as per QAPP Section 7

FORM I-6

LCS ID: enter the unique identification number for the laboratory control sample such that the LCS could be traced back to its source material (the same ID number will be found in the run sequence log (e.g., LCS960603)

Units: enter the appropriate units (i.e., µg/L or mg/kg)

Expected: enter the expected result (i.e., the concentration of the calibration material)

Found: enter the measured result

%R: enter the per cent difference between the expected and found

Control Limits: enter the control limits required to be met (see QAPP Section 7)

Q: enter a "*" for all %Rs that were not acceptable as per QAPP Section 7

FORM I-7

Parent Field Sample ID: enter the field sample ID of the parent sample (the sample spiked for the MS and MSD)

Units: enter the appropriate units (i.e., µg/L or mg/kg)

FORM I- 7 (Continued)

% Solids: enter the % solids

MS ID: enter the unique identification number for the matrix spike such that the MS could be traced back to the source material used for spiking (the same ID number will be found in the run sequence log (e.g., MS960603)

MSD ID: enter the unique identification number for the matrix spike duplicate such that the MSD could be traced back to the source material used for spiking (the same ID number will be found in the run sequence log e.g., MSD960603)

Parent Sample Result: enter the result of the parent sample

Spike Added: enter the amount of spike added to the parent sample

Spike Sample Result: enter the result of the MS

%R: enter the per cent recovery

Duplicate Spike Sample Result: enter the result of the MSD

%RPD: enter the relative per cent difference between the spike (MS) and spike duplicate (MSD)

Control Limits: enter the control limits required to be met (see QAPP Section 7)

Q: enter the qualifier flag as needed (see QAPP Sections 7 and 8)

FORM I-8

Field Sample ID: enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

Date Collected: enter the date the sample was taken in the field in the format DD-MMM-YY (e.g., 6 Jun 96)

Date Received: enter the date the sample was received at the laboratory in the format DD-MMM-YY (e.g., 6 Jun 96)

Date Analyzed: enter the date the sample was analyzed by the laboratory in the format DD-MMM-YY (e.g., 6 Jun 96)

Max. Holding Time: enter the maximum allowable holding time in days (see QAPP Section 5)

Time Held: enter the time in days elapsed between the date collected and the date analyzed

FORM I- 8 (Continued)

Q: enter a "*" for all holding times that were greater than the maximum allowable holding time as per QAPP Section 5

FORM I-9

Instrument ID: enter the instrument identifier (e.g., the serial number or other identifying number/name)

Field Sample ID/Std ID/Blank ID/QC Sample ID: enter the unique identifying number of each samplE (environmental sample, standard, blank, LCS, MS, MSD, etc.) in the sequence they were analyzed

Date Analysis Started: enter the date the sample analysis was started in the format DD-MMM-YY (e.g., 6 Jun 96)

Time Analysis Started: enter the time the sample analysis was started in 24 hour format (e.g., 0900, 2130)

Date Analysis Completed: enter the date the sample analysis was completed in the format DD-MMM-YY (e.g., 6 Jun 96)

Time Analysis Completed: enter the time the sample analysis was completed in 24 hour format (e.g., 0900, 2130)

FORM O-1

Base/Command: enter the base name and the Air Force command (e.g., Banks AFB/ SPACECOM)

Prime Contractor: enter the name of the prime contractor (e.g., RDS, Inc)

Field Sample ID: enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

Lab Sample ID: enter the unique identifying number given to the sample by the laboratory that corresponds to the Field Sample ID

FORM O-2

Field Sample ID: enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

Lab Sample ID: enter the unique identifying number given to the sample by the laboratory that corresponds to the Field Sample ID

Matrix: enter the sample matrix (e.g., water, soil)

FORM O-2 (Continued)

% Solids: enter the % solids

Dilution: enter the dilution (if applicable) (e.g., 1:5)

Date Received/Extracted/Analyzed: enter the appropriate dates in the format DD-MMM-YY (e.g., 3 Jun 96)

Concentration Units: enter the appropriate units (i.e., µg/L or mg/kg)

MDL: enter the laboratory derived method detection limit

PQL: enter the project practical quantitation limit as stated in the QAPP or approved variance for each analyte

Concentration: enter the result

Qualifier: enter the qualifier flag as needed (see QAPP Sections 7)

FORM O-3

Instrument ID: enter the instrument identifier (e.g., the serial number or other identifying number/name)

Compound: enter BFB or DFTPP as appropriate

Injection Date/Time: enter the date (in the format DD-MMM-YY) and time (in 24 hour format) of the performance check

Mass: enter the mass of the ion used for tuning (see QAPP Section 7)

Ion Abundance Criteria: enter the criteria for the specific mass (see QAPP Section 7)

% Relative Abundance: enter the per cent relative abundance as the result of the tune

Q: enter a "*" for all % relative abundance results that were not acceptable as per QAPP Section 7

Field Sample ID/Std ID/Blank ID/QC Sample ID: enter the unique identifying number of each sample (environmental sample, standard, blank, LCS, MS, MSD, etc.)

Date Analyzed: enter the date the sample was analyzed by the laboratory in the format DD-MMM-YY (e.g., 3 June 96)

FORM Q-3 (continued)

Time Analyzed: enter the time the sample was analyzed by the laboratory in 24 hour format (e.g., 0900, 2130)

FORM Q-4

Instrument ID: enter the instrument identifier (e.g., the serial number or other identifying number/name)

Date of Calibration: enter the appropriate date in the format DD-MMM-YY (e.g., 3 June 96)

Calibration ID: enter the unique identifier for the specific calibration event

RF Blank, RF1, RF2, RF3, RF4, RF5: enter the response factor corresponding to the standard with the same number. RF Blank is the response factor for the blank

Std 1, Std 2, Std 3, Std 4, Std 5: enter the concentration of the standard

%RSD: enter the per cent relative standard deviation

Q: enter a "*" for all % RSDs that were not acceptable as per QAPP Section 7

FORM Q-5

Instrument ID: enter the instrument identifier (e.g., the serial number or other identifying number/name)

Date of Calibration: enter the appropriate date in the format DD-MMM-YY (e.g., 3 June 96)

2nd Source ID: enter the unique identifier for the 2nd source standard such that the standard could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., 2S960603)

CCV #1 ID: enter the unique identification number for the first CCV such that the CCV could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., CCV960603-1)

CCV #2 ID: enter the unique identification number for the second CCV such that the second CCV could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., CCV960603-2)

FORM Q-5 (continued)

Expected, Expected 1: enter the expected result (i.e., the concentration of the calibration material)

Found, Found 1, Found 2: enter the measured result

%D: enter the per cent difference between the expected and found

Q: enter a "*" for all % Ds that were not acceptable as per QAPP Section 7

FORM Q-5A

Instrument ID: enter the instrument identifier (e.g., the serial number or other identifying number/name)

Date of Calibration: enter the appropriate date in the format DD-MMM-YY (e.g., 3 June 96)

SPCC #1 ID: enter the unique identification number for the SPCC associated with the initial multipoint calibration such that the SPCC could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., SPCC960603-1)

SPCC #2 ID: enter the unique identification number for the SPCC associated with the daily calibration such that the SPCC could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., SPCC960603-2)

SPCC #2 ID: enter the unique identification number for the SPCC run after 12 hours of operation such that the SPCC could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., SPCC960603-3)

CCC #2 ID: enter the unique identification number for the CCC associated with the daily calibration such that the CCC could be traced back to its source material (the same ID number will be found in the run seqùence log, e.g., CCC960603-2)

CCC #2 ID: enter the unique identification number for the CCC run after 12 hours of operation such that the CCC could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., CCC960603-3)

RF: enter the response factor

Min RF: enter the minimum acceptable response factor (see QAPP Section 7)

Expected: enter the expected result (i.e., the concentration of the calibration material)

Found: enter the measured result

FORM O-5 **(continued)**

%D: enter the per cent difference between the expected and found

Q: enter a "*" for (1) any % Ds that were not acceptable or (2) any RFs not meeting minimum acceptable requirements as per QAPP Section 7

FORM O-6

Units: enter the appropriate units (i.e., µg/L or mg/kg)

Method Blank ID: enter the unique identification number for the method blank (the same ID number will be found in the run sequence log, e.g., MB960603)

Analyte: enter the name of the analyte (use the same name as used in the tables in Section 7 of the QAPP)

Method Blank: enter the result for the method blank

PQL: enter the project practical quantitation limit as stated in this QAPP or approved variance for each analyte

Q: enter a "*" for all method blank analyte results that were not acceptable as per QAPP Section 7

FORM O-7

LCS ID: enter the unique identification number for the laboratory control sample such that the LCS could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., LCS960603)

Units: enter the appropriate units (i.e., µg/L or mg/kg)

Analyte: enter the name of the analyte (use the same name as used in the tables in Section 7 of the QAPP)

Expected: enter the expected result (i.e., the concentration of the calibration material)

Found: enter the measured result

%R: enter the per cent recovery

Control Limits: enter the control limits required to be met (see QAPP Section 7)

Q: enter a "*" for all % Rs that were not acceptable as per QAPP Section 7

FORM O-8

Parent Field Sample ID: enter the field sample ID of the parent sample (the sample spiked for the MS and MSD)

Units: enter the appropriate units (i.e., µg/L or mg/kg)

% Solids: enter the % solids

MS ID: enter the unique identification number for the matrix spike such that the MS could be traced back to the source material used for spiking (the same ID number will be found in the run sequence log, e.g., MS960603)

MSD ID: enter the identification number for the matrix spike duplicate such that the MSD could be traced back to the source material used for spiking (the same ID number will be found in the run sequence log, e.g., MSD960603)

Parent Sample Result: enter the result of the parent sample

Spike Added: enter the amount of spike added to the parent sample

Spike Sample Result: enter the result of the MS

%R: enter the per cent recovery

Duplicate Spike Sample Result: enter the result of the MSD

%RPD: enter the relative per cent difference between the spike (MS) and spike duplicate (MSD)

Control Limits: enter the control limits required to be met (see QAPP Section 7)

Q: enter the qualifier flag as needed (see QAPP Sections 7)

FORM O-9

Field Sample ID: enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

Date Collected: enter the date the sample was taken in the field in the format DD-MMM-YY (e.g., 3 Jun 96)

Date Received: enter the date the sample was received at the laboratory in the format DD-MMM-YY (e.g., 3 Jun 96)

Date Extracted: enter the date the sample was extracted by the laboratory in the format DD-MMM-YY (e.g., 3 Jun 96)

FORM O-9 (Continued)

Max. Holding Time E: enter the maximum allowable holding time in days until the sample is extracted (see QAPP Section 5)

Time Held Ext.: enter the time in days elapsed between the date collected and the date extracted

Date Analyzed: enter the date the sample was analyzed by the laboratory in the format DD-MMM-YY (e.g., 3 Jun 96)

Max. Holding Time A: enter the maximum allowable holding time in days until the sample is analyzed (see QAPP Section 5)

Time Held Anal.: enter the time in days elapsed between the date collected and the date analyzed

Q: enter a "*" for all holding times (Max. Holding Time E, or Max. Holding Time A, or Time Held Anal.) that were greater than the maximum holding time that were not acceptable as per QAPP Section 5

FORM O-10

Instrument ID: enter the instrument identifier (e.g., the serial number or other identifying number/name)

Field Sample ID/Std ID/Blank ID/QC Sample ID: enter the unique identifying number of each sample (environmental sample, standard, blank, LCS, MS, MSD, etc.) in the sequence they were analyzed

Date Analysis Started: enter the date the sample analysis was started in the format DD-MMM-YY (e.g., 3 Jun 96)

Time Analysis Started: enter the time the sample analysis was started in 24 hour format (e.g., 0900, 2130)

Date Analysis Completed: enter the date the sample analysis was completed in the format DD-MMM-YY (e.g., 3 Jun 96)

Time Analysis Completed: enter the time the sample analysis was completed in 24 hour format (e.g., 0900, 2130)

Form S-1

Base/Command: enter the base name and the Air Force command (e.g., Banks AFB/ SPACECOM)

Prime Contractor: enter the name of the prime contractor (e.g., RDS, Inc)

Field Sample ID: enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

FORM S-2

Field Sample ID: enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

Matrix: enter the sample matrix (e.g., water, soil)

Date Analyzed: enter the appropriate dates in the format DD-MMM-YY (e.g., 3 Jun 96)

Concentration Units: enter the appropriate units (i.e., µg/L or mg/kg)

MDL: enter the laboratory derived method detection limit

PQL: enter the project practical quantitation limit as stated in the QAPP or approved variance for each analyte

Concentration: enter the result

Qualifier: enter the qualifier needed (see QAPP Sections 7 and 8)

FORM S-3

Units: enter the appropriate units units (i.e., µg/L or mg/kg)

Sample Result: enter the result of the sample

Duplicate Sample Result: enter the result of the duplicate sample

%D or %RPD: enter the per cent or difference relative per cent difference between the sample and duplicate

Acceptance Criteria: enter the acceptance criteria required to be met (see QAPP Section 6)

Q: enter a "*" for all % Ds or % RPDs that were not acceptable as per QAPP Section 6

MDL FORM

Analyte: enter the name of the analyte (use the same name as used in the tables in Section 7 of the QAPP)

Amt. Spiked: enter the amount of spike added to the parent sample

Replicate 1,2,3,4,5,6,7: enter the result of the replicate

Std. Dev.: enter the standard deviation of the seven replicates

MDL: enter the calculated MDL

CHAIN OF CUSTODY FORM

COC#: enter a unique number for each chain of custody form

Ship to: enter the laboratory name and address

Carrier: enter the name of the transporter (e.g., FedEx) or handcarried

Airbill#: enter the airbill number or transporter tracking number (if applicable)

Project Name: enter the project name (e.g., Banks AFB RI/FS)

Sampler Name: enter the name of the person collecting the samples

Sampler Signature: signature of the person collecting the samples

Send Results to: enter the name and address of the prime contractor

Field Sample ID: enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

Date: enter the year and date the sample was collected in the format M/D (e.g., 6/3)

Time: enter the time the sample was collected in 24 hour format (e.g., 0900)

Matrix: enter the sample matrix (e.g., water, soil)

Pres: enter the preservative used (e.g., HNO3) or "none"

CHAIN OF CUSTODY FORM **(continued)**

Filtered/Unfilt.: enter "F" if the sample was filtered or "U" if the sample was not filtered

# of Containers: enter the number of containers associated with the sample

MS/MSD: enter "X" if the sample is designated the MD/MSD

Analyses Requested: enter the method name of the analysis requested (e.g., SW6010A)

Comments: enter comments

Sample Condition Upon Receipt at Laboratory: enter any probems with the condition of any sample(s)

Cooler Temperature: enter the internal temperature of the cooler, in degrees C, upon opening

Special Instructions/Comments: enter any special instructions or comments

Released by: (SIG): enter the signature of the person releasing custody of the samples

Company Name: enter the company name employing the person releasing/ receiving custody

Received by: (SIG): enter the signature of the person receiving custody of the samples

Date: enter the date in the format M/D/YY (e.g., 6/3/96) when the samples were released/received

Time: enter the time in 24 hour format (e.g., 0900) when the samples were released/received

AFCEE
INORGANIC ANALYSES DATA PACKAGE

Analytical Method: ____________________ AAB #: ____________________

Lab Name: ____________________ Contract #: ____________________

Base/Command: ____________________ Prime Contractor: ____________________

Field Sample ID	Lab Sample ID

Comments:

I certify this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: ____________________ Name: ____________________

Date: ____________________ Title: ____________________

AFCEE FORM I-1

AFCEE
INORGANIC ANALYSES DATA SHEET 2
RESULTS

Analytical Method: ______________ AAB #: ____________________________

Lab Name: ___________________________ Contract #: _________________________

Field Sample ID: _________________ Lab Sample ID: _____________________

Matrix: ________ % Solids: ________ Dilution: _________________________

Date Received: ______________ Date extracted: ______________ Date Analyzed: ________

Concentration Units ug/L or mg/kg dry weight): ________________

Analyte	MDL	PQL	Concentration	Qualifier

Comments:

____

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AFCEE
INORGANIC ANALYSES DATA SHEET 3
INITIAL MULTIPOINT CALIBRATION

Analytical Method: ____________________ AAB #: ______________________

Lab Name: __________________________ Contract #: ___________________

Instrument ID: ________________________ Date of Calibration: ____________

Analyte	RF Blank	Std 1	RF 1	Std 2	RF 2	Std 3	RF 3	r	Q

r = correlation coefficient

Comments:
____
____
____
____

AFCEE
INORGANIC ANALYSES DATA SHEET 3
MERCURY INITIAL MULTIPOINT CALIBRATION

Analytical Method: ____________________ AAB #: ____________________

Lab Name: ____________________ Contract #: ____________________

Instrument ID: ____________________ Date of Calibration: ____________

Analyte	RF Blank	Std 1	RF 1	Std 2	RF 2	Std 3	RF 3	Std 4	RF 4	Std 5	RF 5	r	Q
Mercury													

r = correlation coefficient

Comments:

AFCEE
INORGANIC ANALYSES DATA SHEET 3
CYANIDE INITIAL MULTIPOINT CALIBRATION

Analytical Method: ____________________ AAB #: ____________________

Lab Name: ____________________ Contract #: ____________________

Instrument ID: ____________________ Date of Calibration: ____________________

Analyte	RF Blank	Std 1	RF 1	Std 2	RF 2	Std 3	RF 3	Std 4	RF 4	Std 5	RF 5	Std 6	RF 6	r	Q
Cyanide															

r = correlation coefficient

Comments:

____

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AFCEE
INORGANIC ANALYSES DATA SHEET 4
CALIBRATION VERIFICATION

Analytical Method:____________________ AAB #:____________________

Lab Name:____________________ Contract #:____________________

Instrument ID:____________________ Date of Calibration:____________________

Highest Std ID:____________________ 2nd Source ID:____________________

CCV #1 ID:____________________ CCV #2 ID:____________________

Analyte	Highest or 2nd Source Calibration			Continuing Calibration Verification					Q
	Expected	Found	%D	Expected 1	Found 1	%D	Found 2	%D	

Comments:

AFCEE FORM I-4

AFCEE
INORGANIC ANALYSES DATA SHEET 5
BLANKS

Analytical Method: ____________________ AAB #: ____________________

Lab Name: ____________________ Contract #: ____________________

Units: ____________________ Calibration Blank ID: ____________________

Method Blank ID: ____________________ CCB #1 ID: ____________________

CCB #2 ID: ____________________ CCB #3 ID: ____________________

Analyte	Calibration Blank	Continuing Calibration Blank			Method Blank	PQL	Q
		1	2	3			

Comments:

AFCEE FORM I-5

AFCEE
INORGANIC ANALYSES DATA SHEET 6
LABORATORY CONTROL SAMPLE

Analytical Method: ____________________ AAB #: ____________________

Lab Name: ____________________ Contract #: ____________________

LCS ID: ____________________ Units: ____________________

Analyte	Expected	Found	%R	Control Limits	Q

Comments:

AFCEE
INORGANIC ANALYSES DATA SHEET 7
MATRIX SPIKE/MATRIX SPIKE DUPLICATE SAMPLE RECOVERY

Analytical Method: ____________________ AAB #: ______________________

Lab Name: _________________________ Contract #: ____________________

Parent Field Sample ID: ________________ Units: ________________________

% Solids: __________ MS ID: ______________ MSD ID: _______________

Analyte	Parent Sample Result	Spike Added	Spiked Sample Result	%R	Duplicate Spike Sample Result	%R	%RPD	Control Limits %R	Control Limits %RPD	Q

Comments:

____

____

____

____

AFCEE
INORGANIC ANALYSES DATA SHEET 8
HOLDING TIMES

Analytical Method:________________________ AAB #:____________________________

Lab Name:______________________________ Contract #:________________________

Field Sample ID	Date Collected	Date Received	Date Analyzed	Max. Holding Time (days)	Time Held (days)	Q

Comments:
____
____
____
____

AFCEE FORM I-8

AFCEE
INORGANIC ANALYSES DATA SHEET 9
INSTRUMENT ANALYSIS SEQUENCE LOG

Analytical Method:____________________ AAB #:____________________

Lab Name:____________________ Contract #:____________________

Instrument ID #:________________

Field Sample ID/Std ID/ Blank ID/QC Sample ID	Date Analysis Started	Time Analysis Started	Date Analysis Completed	Time Analysis Completed

Comments:

AFCEE
ORGANIC ANALYSES DATA PACKAGE

Analytical Method:________________ AAB #:________________

Lab Name: ________________ Contract #:________________

Base/Command: ________________ Prime Contractor:________________

Field Sample ID	Lab Sample ID

Comments:

I certify this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data coutained in this hardcopy data package and in the computer-readable data submitted on diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature:________________ Name:________________

Date:________________ Title:________________

AFCEE FORM O-1

AFCEE
ORGANIC ANALYSES DATA SHEET 2
RESULTS

Analytical Method:____________________ AAB #________________________

Lab Name:________________________ Contract #______________________

Field Sample ID:____________________ Lab Sample ID:__________________

Matrix:____________ % Solids:__________ Dilution:__________

Date Received:__________ Date extracted:__________ Date Analyzed:__________

Concentration Units (ug/L or mg/kg dry weight): ____________

Analyte	MDL	PQL	Concentration	Qualifier

Comments:

AFCEE
ORGANIC ANALYSES DATA SHEET 3
INSTRUMENT PERFORMANCE CHECK
(BFB or DFTPP)

Analytical Method:____________________ AAB #:________________________

Lab Name:__________________________ Contract #:______________________

Instrument ID:______________Compound:__________ Injection Date/Time:__________

Mass	Ion Abundance Criteria	% Relative Abundance	Q

THIS CHECK APPLIES TO THE FOLLOWING SAMPLES, STANDARDS, BLANKS AND SPIKES:

Field Sample #/Std ID/ Blank ID/QC Sample ID	Date Analyzed	Time Analyzed

AFCEE
ORGANIC ANALYSES DATA SHEET 4
INITIAL MULTIPOINT CALIBRATION

Analytical Method:________________________ AAB #:____________________

Lab Name:____________________________ Contract #:__________________

Instrument ID:_________________________ Date of Calibration_____________

Calibration ID:________________________

Analyte	RF Blank	Std 1	RF 1	Std 2	RF 2	Std 3	RF 3	Std 4	RF 4	Std 5	RF 5	% RSD	Q

Comments:

____

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AFCEE
ORGANIC ANALYSES DATA SHEET 5
CALIBRATION VERIFICATION

Analytical Method:______________________ AAB #:______________________

Lab Name:______________________ Contract #:____________________

Instrument ID:______________________ Date of Calibration:____________

Calibration ID:______________________ 2nd Source ID________________

CCV #1 ID:______________________ CCV #2 ID:__________________

Analyte	2nd Source Calibration			Continuing Calibration Verification					Q
	Expected	Found	%D	Expected 1	Found 1	%D	Found 2	%D	

Comments:

____
____
____
____

AFCEE
ORGANIC ANALYSES DATA SHEET 5A
SPCC AND CCC CALIBRATION

Analytical Method:________________________ AAB #:______________________________

Lab Name:______________________________ Contract #:____________________________

Instrument ID:___________________________ Date of Calibration:____________________

SPCC #1 ID:_____________________________ SPCC #2 ID:___________________________

SPCC #3 ID:_____________________________

CCC #1 ID:______________________________ CCC #2 ID:____________________________

Analyte	SPCC #1		SPCC #2		SPCC #3		CCC #1			CCC #2			Q
	RF	Min RF	RF	Min RF	RF	Min RF	Expected	Found	%D	Expected	Found	%D	

AFCEE
ORGANIC ANALYSES DATA SHEET 6
BLANKS

Analytical Method:______________________ AAB #:______________________

Lab Name:______________________ Contract #:______________________

Units:______________________ Method Blank ID:______________________

Analyte	Method Blank	PQL	Q

Comments:

AFCEE
ORGANIC ANALYSES DATA SHEET 7
LABORATORY CONTROL SAMPLE

Analytical Method:______________________ AAB #:______________________

Lab Name:______________________ Contract #:______________________

LCS ID:______________________ Units:______________________

Analyte	Expected	Found	%R	Control Limits	Q

Comments:
____
____
____
____

AFCEE
ORGANIC ANALYSES DATA SHEET 8
MATRIX SPIKE/MATRIX SPIKE DUPLICATE SAMPLE RECOVERY

Analytical Method:______________________ AAB #:______________________

Lab Name:______________________ Contract #:______________________

Parent Field Sample ID:______________________ Units:______________ % Solids:______

MS ID:______________________ MSD ID:______________________

Analyte	Parent Sample Result	Spike Added	Spiked Sample Result	%R	Duplicate Spike Sample Result	%R	%RPD	Control Limits	Q

Comments:

AFCEE
ORGANIC ANALYSES DATA SHEET 9
HOLDING TIMES

Analytical Method:________________ AAB #:________________

Lab Name:________________ Contract #:________________

Field Sample ID	Date Collected	Date Received	Date Extracted	Max. Holding Time E	Time Held Ext.	Date Analyzed	Max. Holding Time A	Time Held Anal.	Q

Comments:

AFCEE FORM O-9 Page ___ of _____

AFCEE
ORGANIC ANALYSES DATA SHEET 10
INSTRUMENT ANALYSIS SEQUENCE LOG

Analytical Method:______________________ AAB #:__________________________

Lab Name:__________________________ Contract #:_______________________

Instrument ID #:_______________________

Field Sample ID/Std ID/ Blank ID/QC Sample ID	Date Analysis Started	Time Analysis Started	Date Analysis Completed	Time Analysis Completed

Comments:
____
____
____
____

AFCEE
SCREENING DATA PACKAGE

Analytical Method:____________________ Contract #:____________________

Base/Command:____________________ Prime Contractor:____________________

Field Sample ID

Comments:

Signature:____________________ Name:____________________

Date:____________________ Title:____________________

AFCEE FORM S-1

AFCEE
SCREENING DATA SHEET 2
RESULTS

Analytical Method:____________________

Contract #:__________________________ Field Sample ID:______________

Matrix:______________________________ Date Analyzed:______________

Concentration Units (ug/L or mg/kg dry weight):______________

Analyte	MDL	PQL	Concentration	Qualifier

Comments:

AFCEE
SCREENING DATA SHEET 3
FIELD DUPLICATES

Analytical Method:________________________ Contract #:____________________

Units:_________________________________

Analyte	Sample Result	Duplicate Sample Result	%D or %RPD	Acceptance Criteria	Q

Comments:

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FINAL PAGE

ADMINISTRATIVE RECORD

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